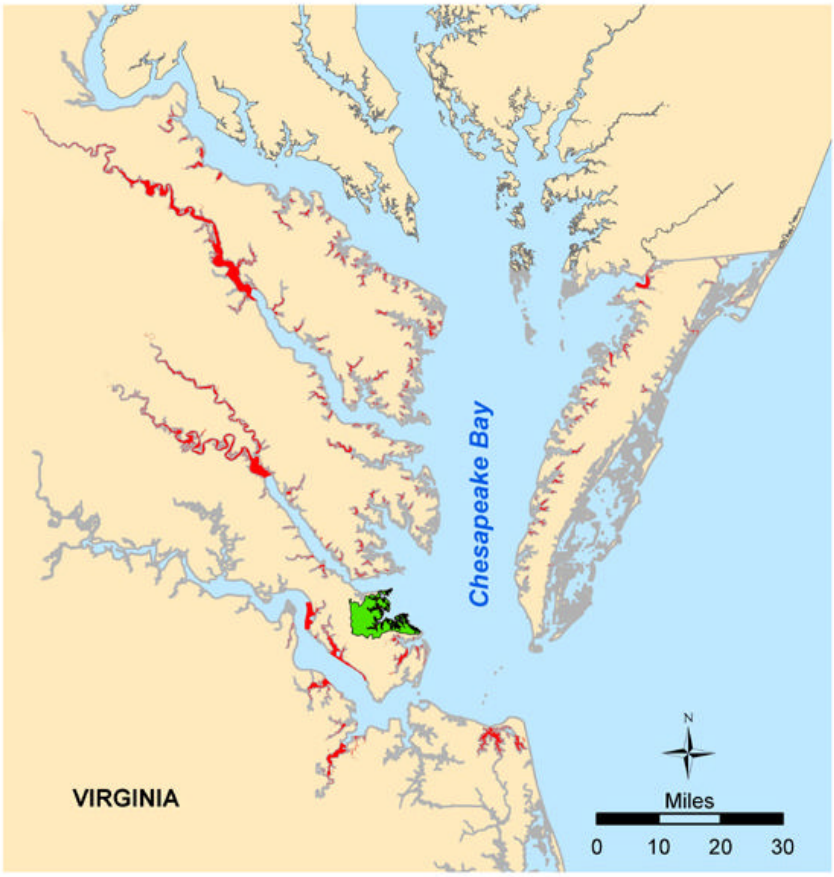
Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacterial Contamination

Poquoson River and Back Creek



DEQ
Virginia Department of Environmental Quality

VDH
Virginia Department of Health
Protecting You and Your Environment

Poquoson River Watershed
Total Maximum Daily Load (TMDL)
Report for Shellfish Condemnation Areas
Listed Due to Bacteria Contamination

Virginia Department of Environmental Quality

April 2006

Table of Contents

Table of Contents

List of Figures

Table of Contents

List of Tables

Total Maximum Daily Load Executive Summary

Total Maximum Daily Load Process

Management of water quality is a process intended to protect waters for a variety of uses. The first step in the process is the identification of desired uses for each waterbody. There are typically a number of physical, chemical and/or biological conditions that must exist in a waterbody to allow for a desired use to exist. In Virginia, most inshore tidal waters are identified as potential shellfish growing waters. In order to support shellfish propagation without risk to human consumers, shellfish waters must have very low levels of pathogenic organisms. Virginia, as most other states, uses fecal coliforms (FC) as an indicator of the potential presence of pathogenic organisms. To maintain the use of a waterbody for direct shellfish harvesting, the goal is to ensure the concentration of fecal coliforms entering the waterbody does not exceed a "safe" level. The safe level is set as the standard against which water quality monitoring samples are checked.

When water quality monitoring detects levels of fecal coliforms above allowable, "safe" levels, managers must identify the potential sources and plan to control them. The prescribed method for figuring out what must be controlled to attain the water quality standard is the calculation of a total maximum daily load (TMDL). The TMDL is the amount of fecal coliforms that may be introduced by each potential source without exceeding the water quality standard for fecal coliforms in shellfish growing waters.

The process of developing a shellfish water TMDL may be generalized in the following manner:

1. Water quality monitoring data are used to determine if the bacterial standard for shellfish have been violated;
2. Potential sources of fecal bacteria loading within the contributing watershed are identified;
3. The necessary reductions in fecal bacteria pollutant load to achieve the water quality standard are determined;
4. The TMDL study is presented to the public to garner comment;
5. An implementation strategy to reduce fecal bacteria loads is written into a plan and subsequently implemented;
6. Water quality monitoring data are used to determine if the bacterial standard is being met for shellfish waters.

Different approaches can be used to determine the sources of fecal pollution in a waterbody. Two distinctly different approaches are watershed modeling and bacterial source tracking (BST). Watershed modeling begins on the land, identifying potential sources based on information about conditions in the watershed (e.g. numbers of residents, estimated wildlife populations, estimated of livestock, etc.). BST begins in the water, identifying sources of fecal coliforms, specifically the dominant fecal coliform *Escherichia coli*, to shellfish waters based on either genetic or phenotypic characteristics of the coliforms. Virginia's Department of Environmental Quality has decided to utilize BST, and specifically to use a method called antibiotic resistance analysis (ARA). This method assumes that fecal bacteria found in four sources: humans, wildlife, livestock, and domestic animals

will all differ in their reactions to antibiotics. Thus, when samples of fecal bacteria collected in the water quality monitoring program are exposed to specific antibiotics the pattern of responses allows matching similarities to the response patterns of bacteria from known sources which have been accumulated in a "source library". Through this analysis investigators also estimate the relative proportion of the fecal bacteria derived from each of the four general source classes and assumes this proportion reflects the relative contribution from the watershed..

The resulting estimates of the amount of fecal coliform pollution coming from each type of source can then be used to allocate reductions necessary to meet the water quality standard for shellfish growing waters. Identifying and agreeing on the means to achieve these reductions represent the TMDL implementation plan.

Continued water quality monitoring will tell whether the efforts to control sources of fecal coliforms in the watershed have succeeded.

Fecal Coliform Impairment

This document details the development of bacterial TMDLs for eight segments in the Poquoson River watershed in the City of Poquoson and York County, Virginia. Seven of the eight impaired areas are fecal coliform impaired condemned shellfish areas in the watershed identified as condemnation number 137A, Chisman Creek (VAT-C07E-23); segment 137B, un-named cove at the mouth of Patricks Creek(VAT-C07E-24); condemnation 137C, Patricks Creek (VAT-C07E-07); condemnation 137D, Poquoson River (VAT-C07E-11); condemnation 137E, Lambs Creek(VAT-C07E-06); condemnation 137F, Roberts Creek(VAT-C07E-08); condemnation 137G, Whitehouse Cove (VAT-C07E-09); and condemnation 151, Back Creek(VAT-C07E-10). Formerly condemned areas in Lyons Creek, Bennett Creek and Eastern Cove, were delisted in October of 2002. The eighth segment, an *enterococci* bacteria impairment identified as VAT-C07E-04, overlies the fecal coliform bacteria shellfish impairment identified as VAT-C07E-11, is also identified as shellfish impairment 137C, Poquoson River. The applicable state standard specifies that the number of fecal coliform bacteria shall not exceed a maximum allowable level of geometric mean of 14 most probable number (3-tube MPN) per 100 milliliters (ml) and a 90^{th} percentile geometric mean value of 49 MPN/100ml. (Virginia Water Quality Standard 9-VAC 25-260-5). In development of this TMDL, the 90^{th} percentile 49 MPN/100 ml was used for shellfish waters, since it represented the more stringent standard. In addition the *enterococci* standard for estuarine and salt water is not to exceed a single sample maximum of 104 c.f.u./100ml **(**Virginia Water Quality Standard 9 VAC 25-260-170). This recreation standard was applied to shellfish waters where *enterococci* and fecal coliform impairments overlapped.

Sources of Fecal Coliform and e*nterococci*

Potential sources of fecal coliform and *enterococci* bacteria consist primarily of non-point source contributions, as there are no permitted point source discharges in the watershed. Non-point sources include wildlife; livestock; land application of bio-solids; recreational vessel discharges; failed, malfunctioning, or non-operational septic systems, and uncontrolled discharges (straight pipes conveying gray water from kitchen and laundry areas of private homes, etc.).

Water Quality Modeling

A volumetric tidal model was used for this TMDL study because the character of the waterbodies to be modeled is relatively simple from a hydrologic perspective: for example, small in area and volume with a single, unrestricted connection to receiving waters. This approach uses the volume of the waterbody and bacterial concetrations in order to establish the existing and allocation conditions.

Determination of Existing Loadings

To assist in partitioning the loads from the diverse sources within the watershed, water quality samples of fecal coliform bacteria were collected for one year and evaluated using an antibiotic resistance analysis in a process called bacterial source tracking. These samples were compared to a reference library of fecal samples from known sources. The resulting data were used to assign portions of the load within the watershed to wildlife, humans, pets or livestock. The results of this analysis indicated that the primary source of fecal coliforms is wildlife with livestock as secondary contributors. The presence of a large signature attributable to one component is sufficient to establish potential directions for remediation under a future implementation plan.

Bacteria Load Allocation

The next step in the TMDL process was to determine the appropriate water quality standard to be applied. This was set as the 90^{th} percentile standard because the data established that the 90^{th} percentile required the greater reduction for all but the upper Poquoson River where the *enterococci* standard would result in the greatest load reductions. Calculated results of the model for each segment were used to establish the existing load in the system. The load necessary to meet water quality standards was calculated in a similar fashion using the water quality standard criterion in place of the ambient water quality value. The difference between these two numbers represents the necessary level of reduction in each segment.

Finally the results of the BST developed for each segment were used to partition the load allocation that would meet water quality standards according to source. The results of the model, the BST source partitioning and the reductions necessary for each segment are shown below. Where the *enterococci* impairment overlapped the shellfish fecal coliform impairment specific BST data was not available and portioning the load was precluded. However it is assumed that since these parameters are related, similar apportionment would be evidenced.

Margin of Safety

In order to account for uncertainty in modeled output, a margin of safety (MOS) was incorporated into the TMDL development process by making very conservative choices. A margin of safety can be incorporated implicitly in the model through the use of conservative estimates of model parameters, or explicitly as an additional load reduction requirement. Individual errors in model inputs, such as data used for developing model parameters or data used for calibration, may affect the load allocations in a positive or a negative way. The purpose of the MOS is to avoid an overall bias toward load allocations

TMDL Summary for Shellfish Closures in the Poquoson River Watershed (geometric mean)

Condemnation Area	Pollutant Identified	Waste Load Allocation MPN/day	Load Allocation MPN/day	Total Allowable TMDL Load MPN/Day	Margin of Safety
137A Chisman Creek	Fecal Bacteria	7.98E+09	1.25E+11	1.33E+11	Implicit
137B Unamed Cove Patricks Creek	Fecal Bacteria	1.97E+07	3.09E+08	3.28E+08	Implicit
137C Patricks Creek	Fecal Bacteria	7.26E+08	1.14E+10	1.21E+10	Implicit
137D Poquoson River	Fecal Bacteria	3.62E+09	5.67E+10	6.03E+10	Implicit
137E Lambs Creek	Fecal Bacteria	1.21E+09	1.89E+10	2.01E+10	Implicit
137 F Roberts Creek	Fecal Bacteria	2.96E+08	4.64E+09	4.94E+09	Implicit
(DELISTED) Lyons Creek	Fecal Bacteria	7.02E+08	1.10E+10	1.17E+10	Implicit
137G Whitehouse Creek	Fecal Bacteria	1.46E+09	2.29E+10	2.44E+10	Implicit
(DELISTED) Bennett Creek	Fecal Bacteria	2.56E+08	4.00E+09	4.26E+09	Implicit
(DELISTED) Eastern Cove	Fecal Bacteria	3.40E+08	5.32E+09	5.66E+09	Implicit
151 Back Creek	Fecal Bacteria	4.30E+09	6.74E+10	7.17E+10	Implicit

TMDL Summary for Shellfish Closures in the Back Creek Watershed (90th percentile)

Condemnation Area	Pollutant Identified	Waste Load Allocation MPN/day	Load Allocation MPN/day	Total TMDL Load Allocation MPN/day	Margin of Safety
137A Chisman Creek	Fecal Bacteria	2.78E+10	4.36E+11	4.64E+11	Implicit
137B Unamed Cove Patricks Creek	Fecal Bacteria	6.90E+07	1.08E+09	1.15E+09	Implicit
137C Patricks Creek	Fecal Bacteria	2.55E+09	4.00E+10	4.25E+10	Implicit
137D Poquoson River	Fecal Bacteria	1.27E+10	1.98E+11	2.11E+11	Implicit
137E Lambs Creek	Fecal Bacteria	4.22E+09	6.61E+10	7.03E+10	Implicit
137 F Roberts Creek	Fecal Bacteria	1.04E+09	1.63E+10	1.73E+10	Implicit
(DELISTED) Lyons Creek	Fecal Bacteria	2.45E+09	3.84E+10	4.08E+10	Implicit

TMDL Summary for Shellfish Closures in the Back Creek Watershed (90th percentile)

Impaired Waterbody Segment	Volume (m^3)	Bacteria Pollutant	Load Allocation (cfu/day)	Wasteload Allocation (cfu/day)	Total Load Allocation
137G Whitehouse Creek	Fecal Bacteria	5.12E+09	8.03E+10	8.54E+10	Implicit
(DELISTED) Bennett Creek	Fecal Bacteria	8.94E+08	1.40E+10	1.49E+10	Implicit
(DELISTED) Eastern Cove	Fecal Bacteria	1.19E+09	1.86E+10	1.98E+10	Implicit
151 Back Creek	Fecal Bacteria	1.51E+10	2.36E+11	2.51E+11	Implicit

TMDL Summary for the Recreation Use Impairment in the upper Poquoson River Watershed

Impaired Waterbody Segment	Volume (m^3)	Bacteria Pollutant	Load Allocation (cfu/day)	Wasteload Allocation (cfu/day)	Total Load Allocation	Margin of Safety
VAT-C07E-04 Poquoson River, Upper	430830	*enterococci*	4.21E+11	2.69E+10	4.48E+11	Implicit

that are too large for meeting the water quality target. An implicit MOS was used in the development of this TMDL through selection of a water quality standard providing a high level of protection, utilization of entire segment volumes for model calculations, averaging extreme high and low values to ensure that the more protective condition with the largest available data set was addressed and emphasizing watershed-based implementation measures.

Recommendations for TMDL Implementation

The goal of this TMDL was to develop an allocation plan that achieves water quality standards during the implementation phase. Virginia's 1997 Water Quality Monitoring, Information and Restoration Act states in section 62.1-44.19.7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". The TMDL developed for the Poquoson River watershed impairments provides allocation scenarios that will be a starting point for developing implementation strategies. Additional monitoring aimed at targeting the necessary reductions is critical to implementation development. Once established, continued monitoring will aid in tracking success toward meeting water quality milestones.

Public participation is critical to the implementation process. Reductions in non-point source loading is the crucial factor in addressing the problem. These sources cannot be addressed without public understanding of and support for the implementation process. Stakeholder input will be critical from the onset of the implementation process in order to develop an implementation plan that will be truly effective.

Public Participation

During development of the TMDL for the Poquoson River watershed, public involvement was encouraged through a public participation process that included public meetings and stakeholder meetings.

The first public meeting was held on July 20, 2005. A basic description of the TMDL process and the agencies involved was presented and a discussion was held to regarding the source assessment input, bacterial source tracking, and model results. This meeting was followed by development of the final draft TMDL and a review by the stakeholders. The preliminary results of the TMDL study where discusses with local government personnel on January 16, 2006.

Input from these meetings was utilized in the development of the TMDL and improved confidence in the allocation scenarios and TMDL process.

The second public meeting was held on March 16, 2006. The results of the TMDL study and the model results were presented and discussed. The draft TMDL report was made available to all citizens and local governments for comment.

1.0 Introduction

This document details the development of bacterial Total Maximum Daily Load (TMDL) for eight segments in the Poquoson River watershed in York County and the Cities of Poquoson and Hampton, Virginia which are listed as impaired on Virginia's 303(d) Total Maximum Daily Load Priority List. The TMDL is one step in a multi-step process that includes a high level of public participation in order to address water quality issues that can affect public health and the health of aquatic life.

1.1 Listing of Water Bodies under the Clean Water Act

Water quality standards are regulations based on federal or state law that set numeric or narrative limits on pollutants. Water quality monitoring is performed to measure these pollutants and determine if the measured levels are with the bounds of the limits set for the uses designated for the waterbody. The waterbodies which have pollutant levels above the designated standards are considered impaired for the corresponding designated use (e.g. swimming, drinking, shellfish harvest, etc.). The impaired waterways are listed on the §303 (d) list reported to the Environmental Protection Agency. Those waters placed on the list require the development of a TMDL intended to eliminate the impairment and bring the water into compliance with the designated standards.

TMDLs represent the total pollutant loading that a water body can receive without violating water quality standards. The TMDL process establishes the allowable loading of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. By following the TMDL process, states can establish water quality based controls to reduce pollution from both point and non-point sources to restore and maintain the quality of their water resources (EPA, 1991).

Fecal coliform bacteria are the most common cause for the impairments in Virginia shellfish growing waters. This group of bacteria is considered an indicator of the presence of fecal contamination. The most common member of the fecal coliform groups is *Escherichia coli*. Fecal coliforms are associated with the fecal material derived from humans and warm-blooded animals. The presence of fecal coliform bacteria in aquatic environments is an indication that the water may have been contaminated by pathogens or disease-producing bacteria or viruses. Waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis, and hepatitis A. Filter-feeding shellfish can concentrate these pathogens which can be transmitted and cause disease when eaten uncooked. Therefore, the presence of elevated numbers of fecal coliform bacteria is an indicator that a potential health risk exists for individuals consuming raw shellfish. Fecal contamination can occur from point source inputs of domestic sewage or from nonpoint sources of human, (e.g., malfunctioning septic systems) or animal wastes.

Because the fecal coliform indicator does not provide information on the source or origin of fecal contamination, Agencies of the Commonwealth, including the Department of Environmental Quality (DEQ), the Virginia Department of Health – Division of Shellfish sanitation (VDH-DSS) and the Department of Conservation and Recreation (DCR) have worked together with state universities, the U.S. Geological Survey and the U.S. Environmental Protection Agency to develop methods to assess sources of fecal coliforms to assist in development of TMDLs in impaired shellfish waters.

As a group these methods are usually called bacterial or microbial source tracking (BST or MST). This study utilizes bacteria source tracking (BST) to determine the most probable sources of fecal coliform in the water.

To assist with the analysis and development of the TMDLs for impaired shellfish waters, the Department of Environmental Quality has contracted the Virginia Institute of Marine Science (VIMS).

1.2 Overview of the TMDL Development Process

A TMDL study for shellfish waters is the first part of a phased process aimed at restoring water quality. This study is designed to determine how much of the pollutant input needs to be reduced in order to achieve water quality standards. The second step in the process is the development of an implementation plan that identifies which specific control measures are necessary to achieve those reductions, their timing for implementation and at what cost. The implementation plan will also outline potential funding sources. The third step will be the actual implementation process. Implementation will typically occur in stages that allow a review of progress in reducing pollutant input, refine bacteria loading estimates based upon additional data and to make any identified changes to pollutant control measures.

The TMDL development process also must account for seasonal and annual variations in precipitation, flow, land use, and pollutant contributions. Such an approach ensures that TMDLs, when implemented, do not result in violations under a wide variety of scenarios that affect bacterial loading.

2.0 Applicable Water Quality Standard

Water quality standards are provisions of state or federal law which consist of a designated use or set of uses for the waters and water quality criteria based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.). According to Virginia Water Quality Standards (9 VAC 25-260-5), the term *"water quality standards means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.)."*

2.1 Designated Uses and Criteria

Generally, all tidal waters in Virginia are designated as shellfish waters and as suitable for all recreation uses such as swimming and fishing. The identification of the applicable river reaches can be found in the river basin tables at 9VAC25-260-390 et seq. For a shellfish supporting water body to be in compliance with Virginia bacterial standards, VADEQ specifies the following criteria (9 VAC 25-260-160): "*In all open ocean or estuarine waters capable of propagating shellfish or in specific areas where public or leased private shellfish beds are present, and including those waters on which condemnation or restriction classifications are established by the State Department of Health the following criteria for fecal coliform bacteria shall apply; The geometric mean fecal coliform value for a sampling station shall not exceed an MPN (most probable number) of 14 per 100 milliliters. The 90th percentile shall not exceed an MPN of 43 for a 5 tube, 3 dilution test or 49 for a 3 tube, 3 dilution test.*"

The Water Quality Standard for recreation use in non-shellfish waters under 9 VAC 25-260-170 is as follows:

"A. In surface waters, except shellfish waters and certain waters identified in subsections B and C of this section, the following criteria shall apply to protect primary contact recreational uses:

1. Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 ml of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 ml of water. This criterion shall not apply for a sampling station after the bacterial indicators described in subdivision 2 of this subsection have a minimum of 12 data points or after June 30, 2008, whichever comes first.

2. E. coli and enterococci bacteria per 100 ml of water shall not exceed the following:

	Geometric Mean[1]	*Single Sample Maximum*[2]
Freshwater[3]		
E.coli	*126*	*235*
Saltwater and Transition Zone[3]		
enterococci	*35*	*104*

[1] For two or more samples taken during any calendar month.
[2] No single sample maximum for enterococci and E. coli shall exceed a 75% upper one-sided confidence limit based on a site-specific log standard deviation. If site data are insufficient to establish a site-specific log standard deviation, then 0.4 shall be used as the log standard deviation in freshwater and 0.7 shall be as the log standard deviation in saltwater and transition zone. Values shown are based on a log standard deviation of 0.4 in freshwater and 0.7 in saltwater.
[3] See 9 VAC 25-260-140 C for freshwater and transition zone delineation."

It should be noted that the saltwater recreation standard also applies in shellfish waters. However since the shellfish standard for fecal coliform is an order of magnitude lower than the recreational use standard it is the more stringent and controlling standard when only fecal coliforms are of concern. When *enterococci* is the recreation standard it frequently results in a more stringent loading reduction.

2.2 Classification of Virginia's Shellfish Growing Areas

The Virginia Department of Health, Division of Shellfish Sanitation (DSS) is responsible for classifying shellfish waters and protecting the health of bivalve shellfish consumers. The VDH- DSS follows the requirements of the National Shellfish Sanitation Program (NSSP), which is regulated by the U.S. Food and Drug Administration. The NSSP specifies the use of a shoreline survey as its primary tool for classifying shellfish growing waters. Fecal coliform concentrations in water samples collected in the immediate vicinity of the shellfish beds function to verify the findings of the shoreline survey, and to define the border between approved and condemned (unapproved) waters. Much of the DSS effort is focused on locating fecal contamination, and in this manner minimizing the introduction of human pathogens to shellfish waters.

DSS designs and operates the shoreline survey to locate sources of pollution within the watersheds of shellfish growing areas. This is accomplished through a property-by-property inspection of the onsite sanitary waste disposal facilities of most properties on un-sewered sections of watersheds, and investigations of other sources of pollution such as wastewater treatment plants (WTP), marinas, livestock operations, landfills, etc. The information is compiled into a written report with a map showing the location of the sources of real or potential pollution found and sent to the various agencies that are responsible for regulating these concerns in the city or county. Once an onsite problem is identified, local health departments (LHDs), and/or other state and local agencies may play a role in the process of correcting the deficiencies.

The VDH-DSS collects monthly seawater samples at over 2,000 stations in the shellfish growing areas of Virginia. Though they continuously monitor sample data for unusual events, they formally evaluate shellfish growing areas on an annual basis. The annual review uses data from the most recent 30 samples (typically 30 months), collected randomly with respect to weather. The data are assessed to determine whether the water quality standards are met. If the water quality standards are exceeded, the shellfish area is closed for the harvest of shellfish that go directly to market. Those areas that marginally exceed the water quality standard and are closed for the direct marketing of shellfish are eligible for harvest of shellfish under permit from the Virginia Marine Resources Commission and VDH-DSS. The permit establishes controls that in part require shellfish be allowed to depurate for 15 days in clean growing areas or specially designed licensed on shore facilities. Shellfish in growing areas that may be highly polluted, such as those in the immediate vicinity of a wastewater treatment facility (prohibited waters), are not allowed to be moved to clean waters for self purification.

3.0 Watershed Characterization

The Poquoson River watershed is is bordered by the City of Poquoson, City of Hampton and York County. The eight condemned areas in the watershed are condemnation number 137A, Chisman Creek (VAT-C07E-23); condemnation 137B, Un-named Cove at Patricks Creek (VAT-C07E-24); condemnation 137,: Patricks Creek(VAT-C07E-07); condemnation 137D, Poquoson River (VAT-C07E-11) and *enterococci* impairment (VAT-C07E-04); condemnation 137E Lambs Creek (VAT-

C07E-06); condemnation 137F, Roberts Creek(VAT-C07E-08); condemnation 137G, Whitehouse Cove (VAT-C07E-09); and condemnation 151, Back Creek. Former condemnation 137F, Lyons Creek; condemnation 137H, Bennett Creek; and condemnation 137I, Eastern Cove, were de-listed in October of 2004. The condemnation notices for theses waterbodies and their supporting fact sheets can be found in Appendix A. The watershed occupies a landscape position along the central northeastern tip of the peninsula formed between the James River on the south and the York River and Chesapeake Bay on the Northeast. The watershed drains north east to the Chesapeake Bay (Figure 3.0). The watershed is bounded on the southwest by Interstate 64 on the east by route 171, on the west by route 175, Fort Eustis Boulevard. The City of Poquoson and suburban York County are located within the watershed.

The drainage area of the Poquoson River watershed is approximately 39.6 square miles. Population estimated by the 2000 US Census is 34,515.

A map of the land use in the watershed is shown in Figure 3-1. Approximately 11 % of the land use in the watershed is developed as urban and commercial use(See Figure 3-2). As the land use area within the watershed is based upon surface area, the 23% water and 15% wetland reflects that portion of the watershed area occupied by the Poquoson River and its tributaries River. Forest occupies 40% of the land surface and agriculture occupies about 8%. Estimations of the populations of livestock and wildlife, as well as numbers of septic systems within the watershed are shown in Table 3-1. Appendix B: Supporting Documentation and Watershed Assessment, provides a description of data and list of data sources for Table 3-1.

Table 3.1 Animal Populations and Septic Systems Growing Area 53*

Animal Population Type	137A Chisman Creek	137C Patricks Creek	137D Poquoson River	137E Lambs Creek	137F Roberts Creek	137 Lyons Creek (delisted)	137G White-house Cove	137 Bennett Creek (delisted)	137 Eastern Cove (delisted)	151 Back Creek
Geese	295	85	134	104	74	79	81	32	69	106
Duck	427	123	194	150	102	109	118	46	99	153
Horse	17	8	15	1	0	0	0	0	0	3
Chicken	6	2	6	2	0	0	0	0	0	1
Septic	1250	234	1101	511	136	113	200	138	243	465
Raccoon	192	40	174	43	20	18	23	23	56	56
Cattle	12	4	12	2	0	0	0	0	0	2
Deer	253	53	205	87	19	14	15	18	43	84
Dog	820	136	639	296	79	66	232	80	141	207

* estimates based upon land area and extrapolated countywide data

Figure 3.0

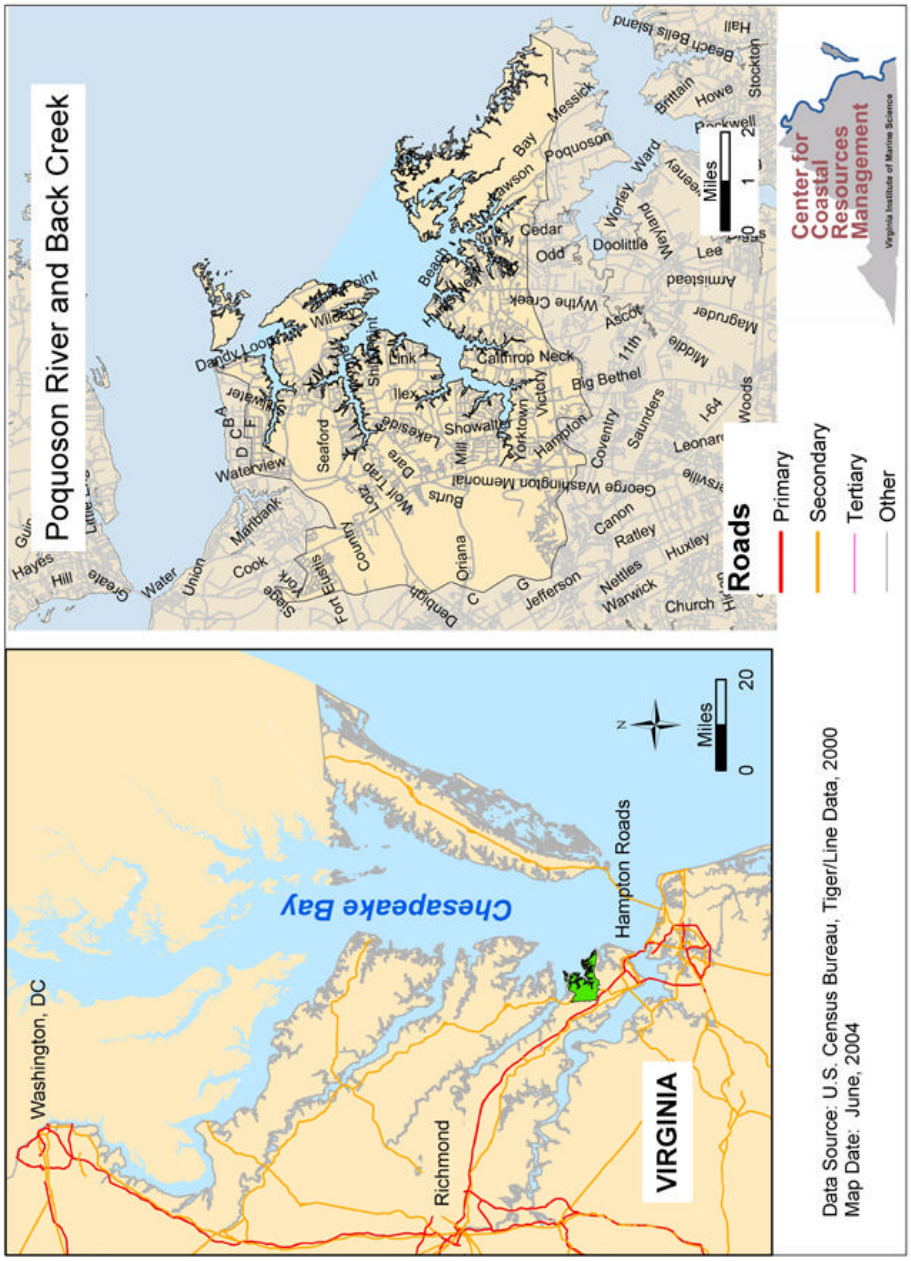
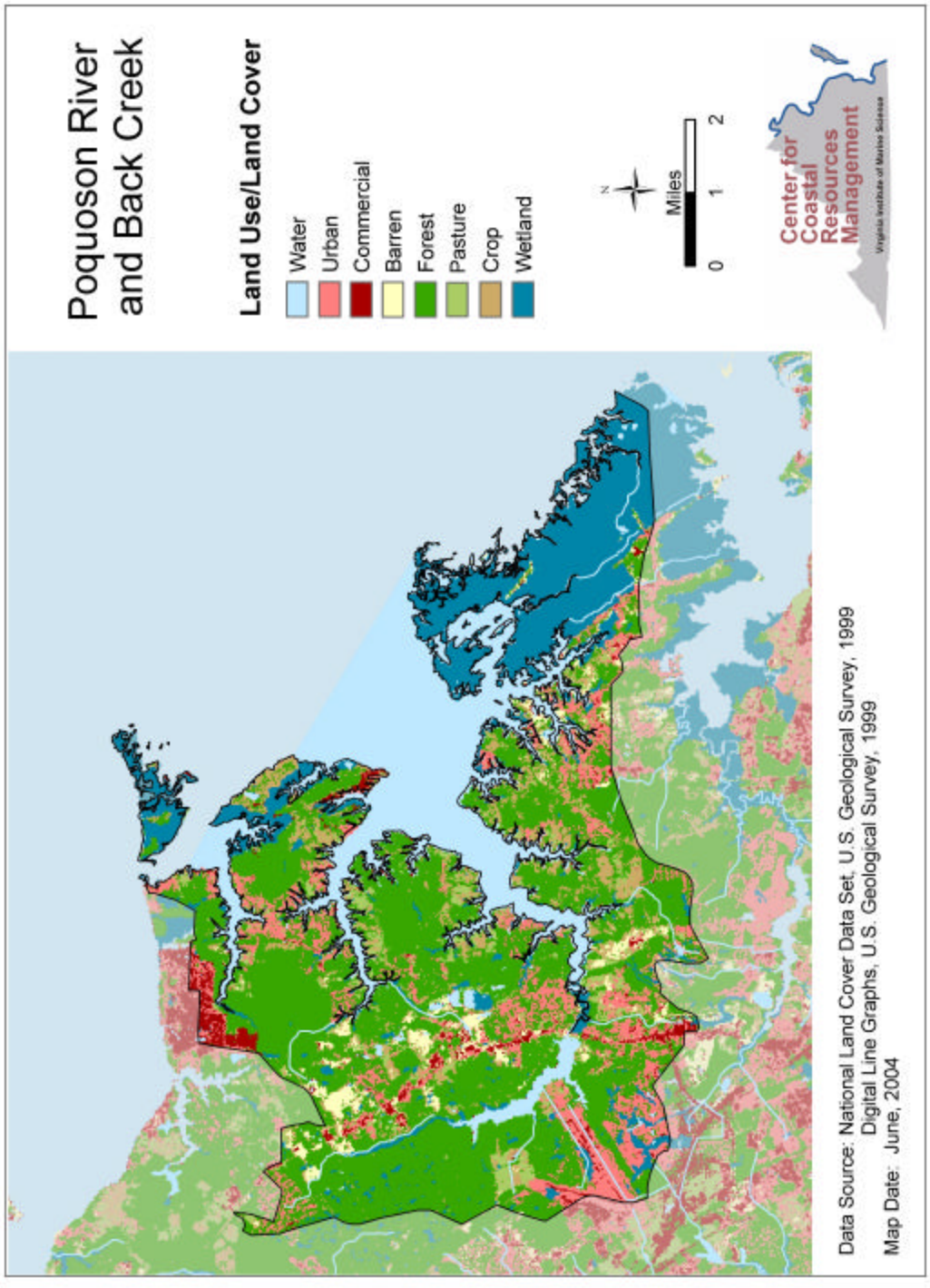

Poquoson River and Back Creek
Roads
Primary
Secondary
Tertiary
Other
Miles
0
1
2
Center for Coastal Resources Management
Virginia Institute of Marine Science
Chesapeake Bay
Hampton Roads
Washington, DC
Richmond
VIRGINIA
Miles
0
20
N
Data Source: U.S. Census Bureau, Tiger/Line Data, 2000
Map Date: June, 2004

Figure 3.1


Poquoson River and Back Creek
Land Use/Land Cover
Water
Urban
Commercial
Barren
Forest
Pasture
Crop
Wetland
N
Miles
0
1
2
Center for Coastal Resources Management
Virginia Institute of Marine Science
Data Source: National Land Cover Data Set, U.S. Geological Survey, 1999
Digital Line Graphs, U.S. Geological Survey, 1999
Map Date: June, 2004

4.0 Water Quality Impairment and Bacterial Source Assessment

4.1 Water Quality Monitoring

The water quality monitoring network consists of 66 monitoring stations. These stations are monitored by the VDH-DSS for fecal bacteria. The locations of the water quality monitoring stations are shown in Figure 4.1. This TMDL study examined bacterial monitoring data at these stations for a period of time from September 2000 through February 2003. A summary of historic water quality data for the monitoring period of record is shown in Table 4.1. Graphs depicting the geometric mean and 90th percentile for the period of this TMDL report are shown in Figures 4.3A and 4.3B. In Table 4.1, a station outside the closure area(s) that shows a maximum value for either the geometric mean, 90th percentile, or both that exceeds the standard, may be due to the inclusion of data collected after 1998. This may provide an indication of water quality issues in the watershed since the time of the 1998 impaired waters listing of areas in this watershed. Only data for those stations associated with a condemnation from 1998, as indicated by a condemnation number in Table 4.1 are used for the TMDLs in this study. Additionally, it should be noted that the data for the last thirty months as required by the water quality standard for this report include a protracted period of anomalous intensive rainfall lasting more than 18 months. This may make recent data less representative of historic conditions.

The closures in the growing areas are characterized based on all monitoring stations (see Figure 4-1) in the closed area. To facilitate an effective assignment of the appropriate level of protection for this system, the water quality data were averaged across all stations in the condemned area. This treats high and low values equally and provides a target that can be easily comprehended and uniformly implemented while retaining the necessary protection for the affected waters.

Figure 3-2

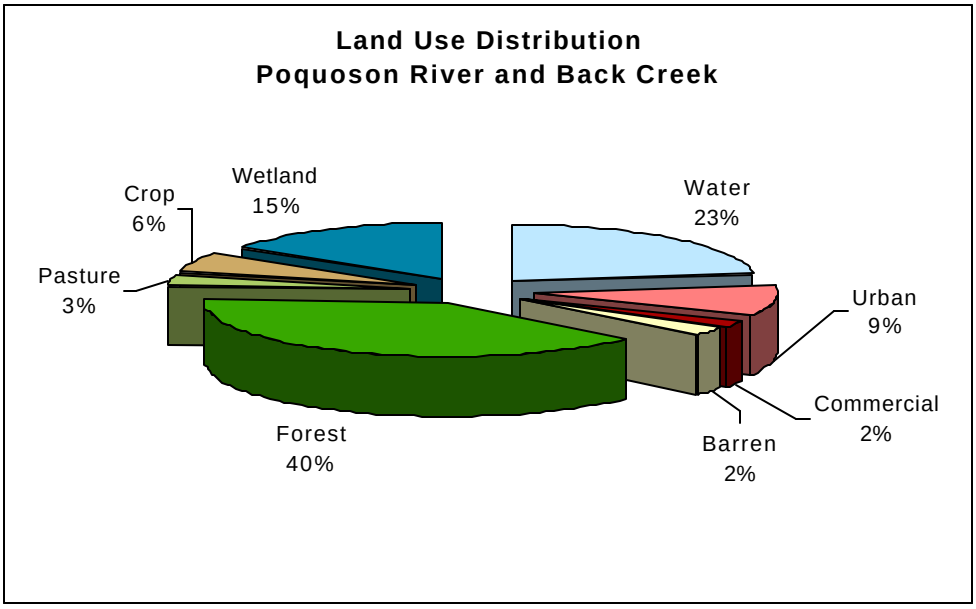


Figure 4.1

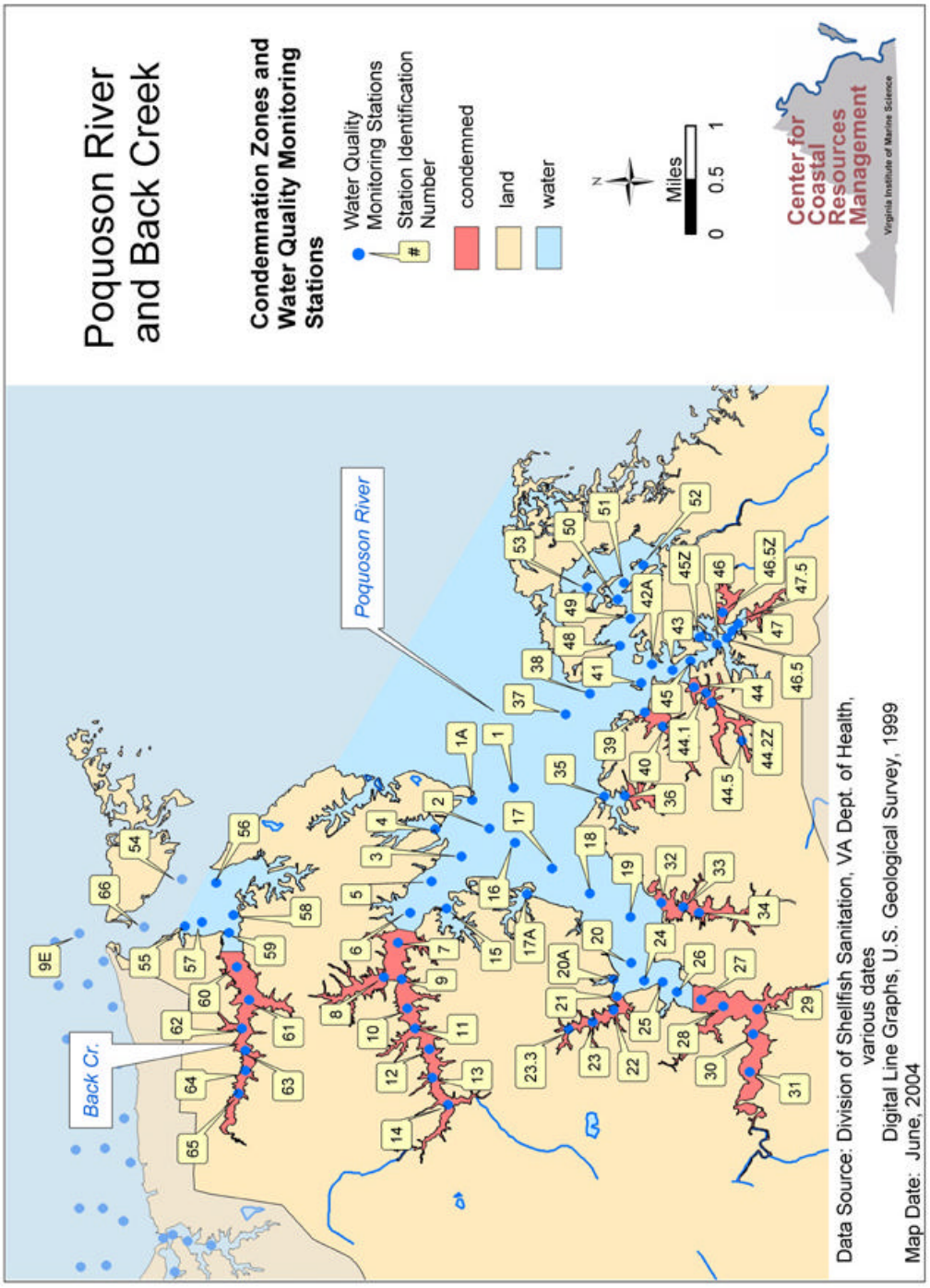

Poquoson River and Back Creek
Condemnation Zones and Water Quality Monitoring Stations
Water Quality Monitoring Stations
Station Identification Number
condemned
land
water
N
Miles
0 0.5 1
Center for Coastal Resources Management
Virginia Institute of Marine Science
Poquoson River
Back Cr.
Data Source: Division of Shellfish Sanitation, VA Dept. of Health, various dates
Digital Line Graphs, U.S. Geological Survey, 1999
Map Date: June, 2004

Figure 4.2

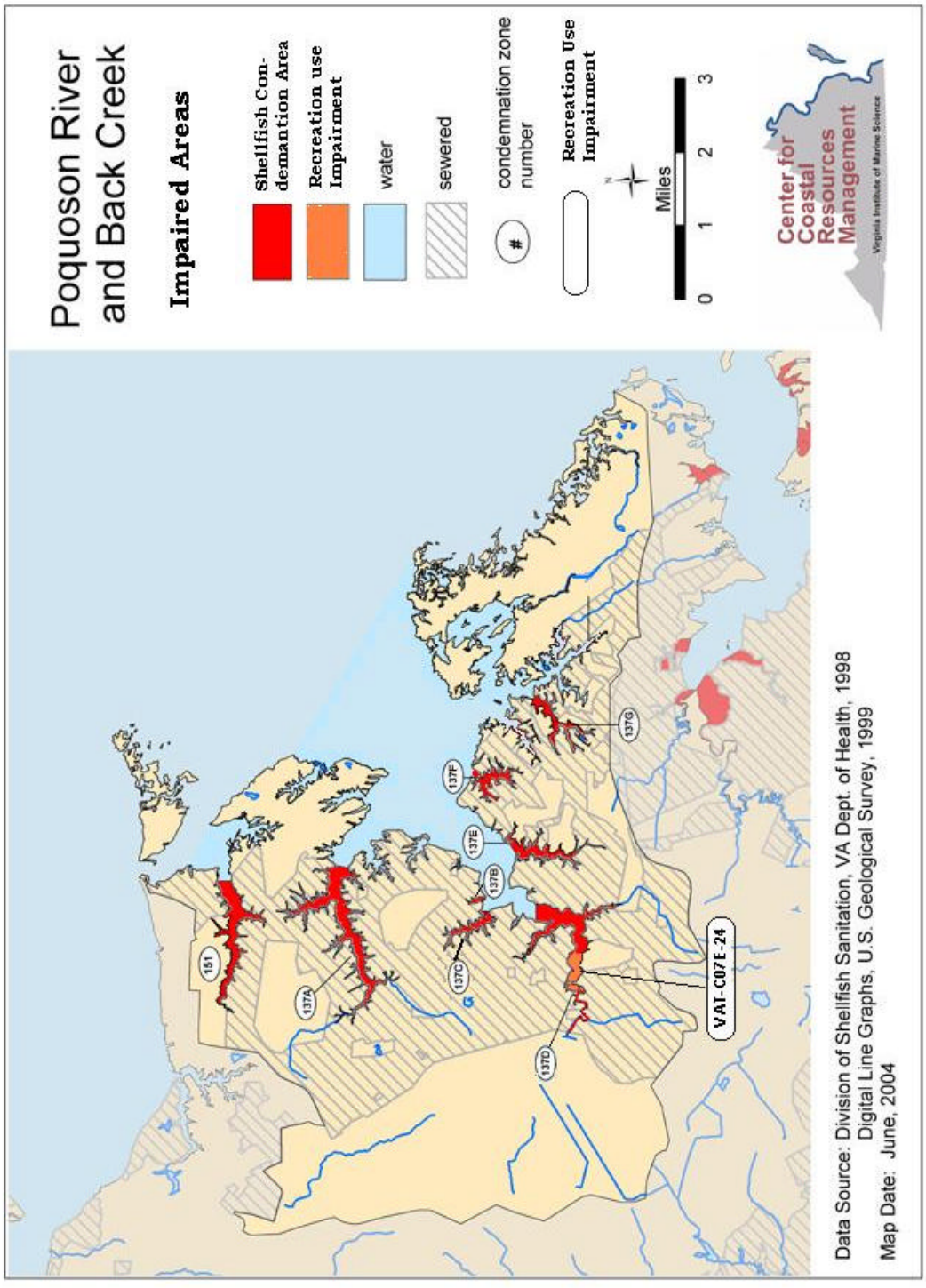

Poquoson River and Back Creek
Impaired Areas
Shellfish Condemantion Area
Recreation use Impairment
water
sewered
condemnation zone number
Recreation Use Impairment
Miles
0 1 2 3
Center for Coastal Resources Management
Virginia Institute of Marine Science
151
137A
137C
137D
137E
137B
137F
137G
VAI-C07E-24
Data Source: Division of Shellfish Sanitation, VA Dept. of Health, 1998
Digital Line Graphs, U.S. Geological Survey, 1999
Map Date: June, 2004

Table 4-1 Water Quality Data Summary: Growing Area 53 Poquoson River

Station	Condemnation Area	Total Observations	Geometric Mean	Violates Geometric Standard: 14 MPN	90th Percentile	Station Violates 90th Percentile Standard: 49 MPN
53-54		186	4.4	No	12.2	No
53-55		186	5.3	No	16.0	No
53-56		185	6.3	No	26.2	No
53-57		186	6.8	No	26.1	No
53-58		186	8.4	No	50.1	Yes
53-59		186	11.2	No	59.2	Yes
53-60	151	186	12.6	No	68.4	Yes
53-61	151	186	11.1	No	60.0	Yes
53-62	151	186	10.5	No	61.7	Yes
53-63	151	186	13.2	No	80.2	Yes
53-64	151	184	18.5	Yes	166.0	Yes
53-65	151	180	25.9	Yes	163.4	Yes
53-66		186	5.1	No	14.0	No
53-1		182	6.4	No	26.2	No
53-10	137A	183	26.6	Yes	238.2	Yes
53-11	137A	182	35.5	Yes	358.9	Yes
53-12	137A	182	35.1	Yes	402.2	Yes
53-13	137A	128	41.5	Yes	457.7	Yes
53-14	137A	126	75.1	Yes	550.8	Yes
53-15		184	12.7	No	57.8	Yes
53-16		184	7.5	No	31.2	No
53-17		129	6.0	No	25.7	No
53-17A		27	7.4	No	36.2	No
53-18		184	8.7	No	57.4	Yes
53-19		184	10.8	No	89.9	Yes
53-1A		183	7.1	No	34.0	No
53-2		129	7.5	No	30.3	No
53-20		184	10.9	No	72.3	Yes
53-20A		25	47.1	Yes	450.7	Yes
53-21		183	22.2	Yes	144.1	Yes
53-22	137B	183	22.4	Yes	124.8	Yes
53-23	137B	181	43.5	Yes	403.6	Yes
53-23.3	137B	173	59.6	Yes	501.6	Yes
53-24		182	14.8	Yes	103.0	Yes
53-25		182	17.3	Yes	150.6	Yes
53-26		183	19.3	Yes	145.3	Yes

Table 4-1 Water Quality Data Summary: Growing Area 53 Poquoson River

Station	Condemnation Area	Total Observations	Geometric Mean	Violates Geometric Standard: 14 MPN	90th Percentile	Station Violates 90th Percentile Standard: 49 MPN
53-27	137C	183	14.4	Yes	96.3	Yes
53-28	137C	183	22.3	Yes	157.6	Yes
53-29	137C	182	28.1	Yes	185.9	Yes
53-3		184	7.8	No	50.8	Yes
53-30	137C	180	37.6	Yes	271.6	Yes
53-31	137C	160	58.9	Yes	432.5	Yes
53-32	137D	183	16.4	Yes	139.7	Yes
53-33	137D	182	31.0	Yes	242.7	Yes
53-34	137D	181	53.9	Yes	491.0	Yes
53-35		130	10.7	No	72.8	Yes
53-36	137E	83	15.1	Yes	196.7	Yes
53-37		127	8.2	No	38.2	No
53-38		182	6.0	No	25.3	No
53-39	137F	180	9.8	No	52.7	Yes
53-4		181	8.5	No	49.9	Yes
53-40	137F	177	17.2	Yes	103.4	Yes
53-41		182	7.9	No	38.9	No
53-42A		183	6.0	No	26.0	No
53-43		183	8.6	No	42.5	No
53-44	137G	183	13.1	No	96.9	Yes
53-44.1	137G	182	17.4	Yes	173.1	Yes
53-44.2Z	137G	182	31.4	Yes	344.4	Yes
53-44.5	137G	181	113.5	Yes	776.6	Yes
53-45	M-213	182	9.6	No	48.0	No
53-45Z		22	7.3	No	31.0	No
53-46		182	11.4	No	62.2	Yes
53-46.5		163	11.3	No	72.0	Yes
53-46.5Z	137I	143	17.2	Yes	108.5	Yes
53-47		182	11.6	No	92.4	Yes
53-47.5	137H	180	14.6	Yes	93.8	Yes
53-48		182	5.8	No	17.2	No
53-49		128	5.1	No	16.1	No

Table 4-1 Water Quality Data Summary: Growing Area 53 Poquoson River

Station	Condemnation Area	Total Observations	Geometric Mean	Violates Geometric Standard: 14 MPN	90th Percentile	Station Violates 90th Percentile Standard: 49 MPN
53-5	M-212	184	11.6	No	84.9	Yes
53-50		182	6.0	No	18.6	No
53-51		180	4.8	No	21.6	No
53-52		124	5.8	No	17.8	No
53-53		115	4.7	No	11.9	No
53-6	M-212	182	12.2	No	82.6	Yes
53-7	137A	183	21.9	Yes	186.0	Yes
53-8	137A	183	18.1	Yes	153.8	Yes
53-9	137A	183	23.2	Yes	278.4	Yes

4.2 Impaired Areas

A. Shellfish Condemnation Areas

Eight segments for the Poquoson River Watershed were listed as impaired on Virginia's 1998 303(d) water quality standard for fecal coliform and/or *enterococci* bacteria in shellfish supporting waters. Detailed maps of the shellfish condemnation areas and their associated water quality stations are available from the Virginia Department of Health, Division of Shellfish Sanitation. A map of the condemnation areas is shown in Figure 4.2. Copies of the condemnation notices and the fact sheets supporting the listing of these waters on the 303(d) list, may be found in Appendix A.

B. Recreation Use Impairments

One segment is listed as impaired for *enterococci* bacteria for recreation use, and overlies the shellfish condemnation in the Poquoson River. These overlapping closures are identified as Shellfish impairment 137D (VAT-C07E-11) and Poquoson River, Upper, recreation impairment (VAT-C007E-04).

4.3 Fecal Coliform Bacteria Source Assessment

The locations of shoreline deficiencies from the DSS shoreline survey are shown in Figure 4.4.

A. Point Source

The are no VPDES permitted wastewater treatment plant point source contributions to affected shellfish waters within the watershed. There are VPDES permitted discharges that are the result of the extensive stormwater system from the Cities of Hampton and Poquoson and from York County. These are Phase II, major stormwater collection systems covered under VPDES permit number VAR040028 for York County, VAR040024 for the City of Poquoson, and a Phase I General Permit, VA0088633, for the City of Hampton.

B. Non-Point Source Contributions

Nonpoint sources of fecal coliform do not have one discharge point but may occur over the entire length of the receiving water. Fecal coliform bacteria deposited on the land surface can build up over time. During rain events, surface runoff transports water and sediment and discharges to the waterway. Sources of fecal coliform bacteria include grazing livestock, concentrated animal feeding operations, manure application and wildlife and pet excretion. livestock or wildlife defecate into or immediately adjacent to receiving waters. Nonpoint source contributions from humans generally arise from failing septic systems and associated drain fields, moored or marina vessel discharges, storm water management facilities, pump station failures and ex-filtration from sewer systems. Contributions from wildlife, both mammalian and avian, are natural conditions and may represent a background level of bacterial loading. It is therefore likely that human loading is due to failures in septic waste treatment systems and/or potential pollution from recreational vessel discharges.

The shoreline survey is used as a tool to identify nonpoint source contribution problems and locations. Figure 4.4 shows the results of the DSS sanitary shoreline survey dated May, 2002. A copy of the textual portion of this survey has been included as Appendix A. The survey identified 58 deficiencies or potential pollution sources. Ten were on-site sewage deficiencies, 10 were related to boating, 9 were potential pollution, 9 were related to animal pollution 10 were solid waste sites and 9 were listed as industrial waste sites. The number of deficiencies displayed on the map may not agree with the total because of the scale of the map and the possibility of multiple deficiencies at one location.

4.4 Bacterial Source Tracking

Bacterial Source tracking is used to identify sources of fecal contamination from human as well as domestic and wild animals. The BST method used in Virginia is based on the premise that *Escherichia coli (E. Coli)* found in human, domestic animal, and wild animals will have significantly different patterns of resistance to a variety of antibiotics. The Antibiotic Resistance Approach (ARA), uses fecal streptococcus or *E. coli* and patterns of antibiotic resistance for separation of sources of the bacterial contribution. The BST analysis used for this TMDL classified the bacteria into one of four source categories: human, pets, livestock, and wildlife. However, BST analysis is an experimental, not approved, technique that is under evaluation and the error involved in correctly assigning *E. coli* isolates to the appropriate fecal sources is unknown.

Figure 4.1 shows the TMDL study stations, a subset of these are the BST monitoring stations for the Poquoson River, Growing Area 53 and include at least one BST monitoring station per shellfish closure. In any case where there was no BST data available for an impaired water, the BST data for the most similar watershed was used. If more than one BST station was available the data was averaged. The data developed for the watershed show that the dominant contribution in Chisman Creek, Condemnation 137A is wildlife followed by livestock, humans and pets. The dominant contribution in Patricks Creek Watershed, Condemnation 137C is livestock followed by wildlife, human and pets. The dominant contribution in the Poquoson River, Condemnation 137D is wildlife followed by human, livestock and pets. For Lambs Creek,

Figure 4.3A

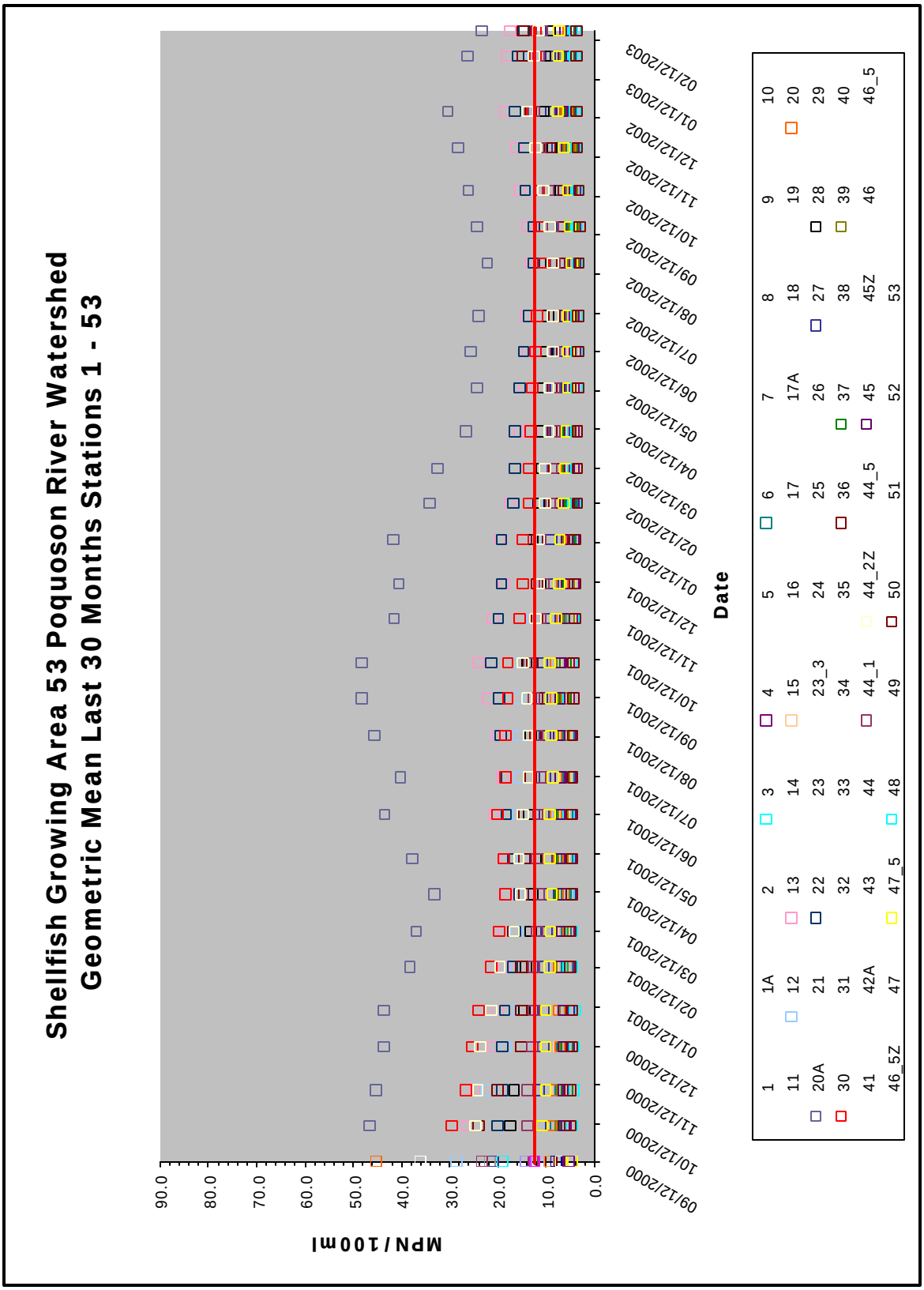

Shellfish Growing Area 53 Poquoson River Watershed
Geometric Mean Last 30 Months Stations 1 - 53
MPN / 100ml
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
09/12/2000
10/12/2000
11/12/2000
12/12/2000
01/12/2001
02/12/2001
03/12/2001
04/12/2001
05/12/2001
06/12/2001
07/12/2001
08/12/2001
09/12/2001
10/12/2001
11/12/2001
12/12/2001
01/12/2002
02/12/2002
03/12/2002
04/12/2002
05/12/2002
06/12/2002
07/12/2002
08/12/2002
09/12/2002
10/12/2002
11/12/2002
12/12/2002
01/12/2003
02/12/2003
Date
1
1A
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
17A
18
19
20
20A
21
22
23
23_3
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42A
43
44
44_1
44_2Z
44_5
45
45Z
46
46_5
46_5Z
47
47_5
48
49
50
51
52
53

Figure 4.3B

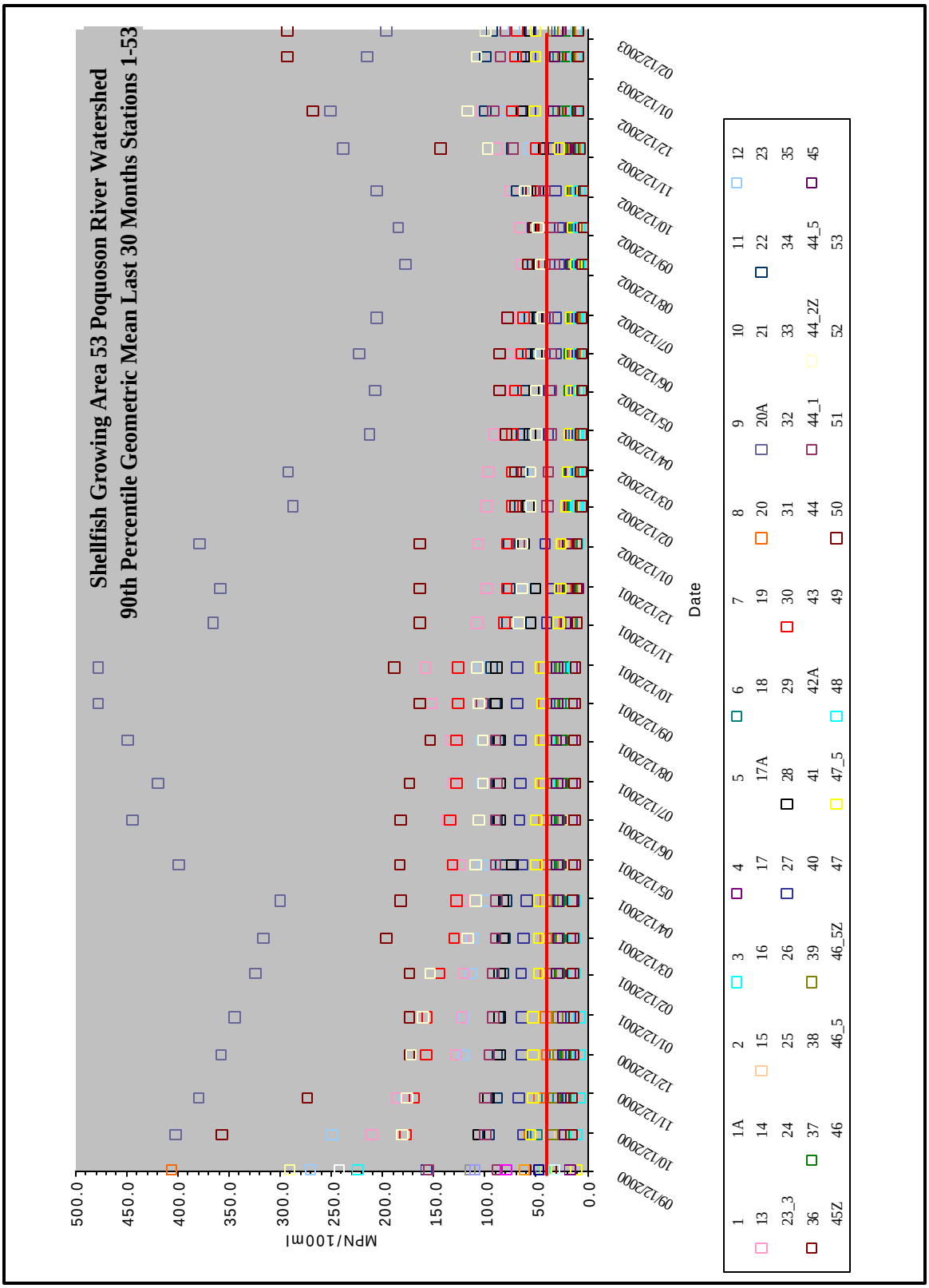

Shellfish Growing Area 53 Poquoson River Watershed
90th Percentile Geometric Mean Last 30 Months Stations 1-53
MPN/100ml
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
Date
09/12/2000
10/12/2000
11/12/2000
12/12/2000
01/12/2001
02/12/2001
03/12/2001
04/12/2001
05/12/2001
06/12/2001
07/12/2001
08/12/2001
09/12/2001
10/12/2001
11/12/2001
12/12/2001
01/12/2002
02/12/2002
03/12/2002
04/12/2002
05/12/2002
06/12/2002
07/12/2002
08/12/2002
09/12/2002
10/12/2002
11/12/2002
12/12/2002
01/12/2003
02/12/2003
1
1A
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
17A
18
19
20
20A
21
22
23
23_3
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42A
43
44
44_1
44_2Z
44_5
45
45Z
46
46_5
46_5Z
47
47_5
48
49
50
51
52
53

Figure 4.3C

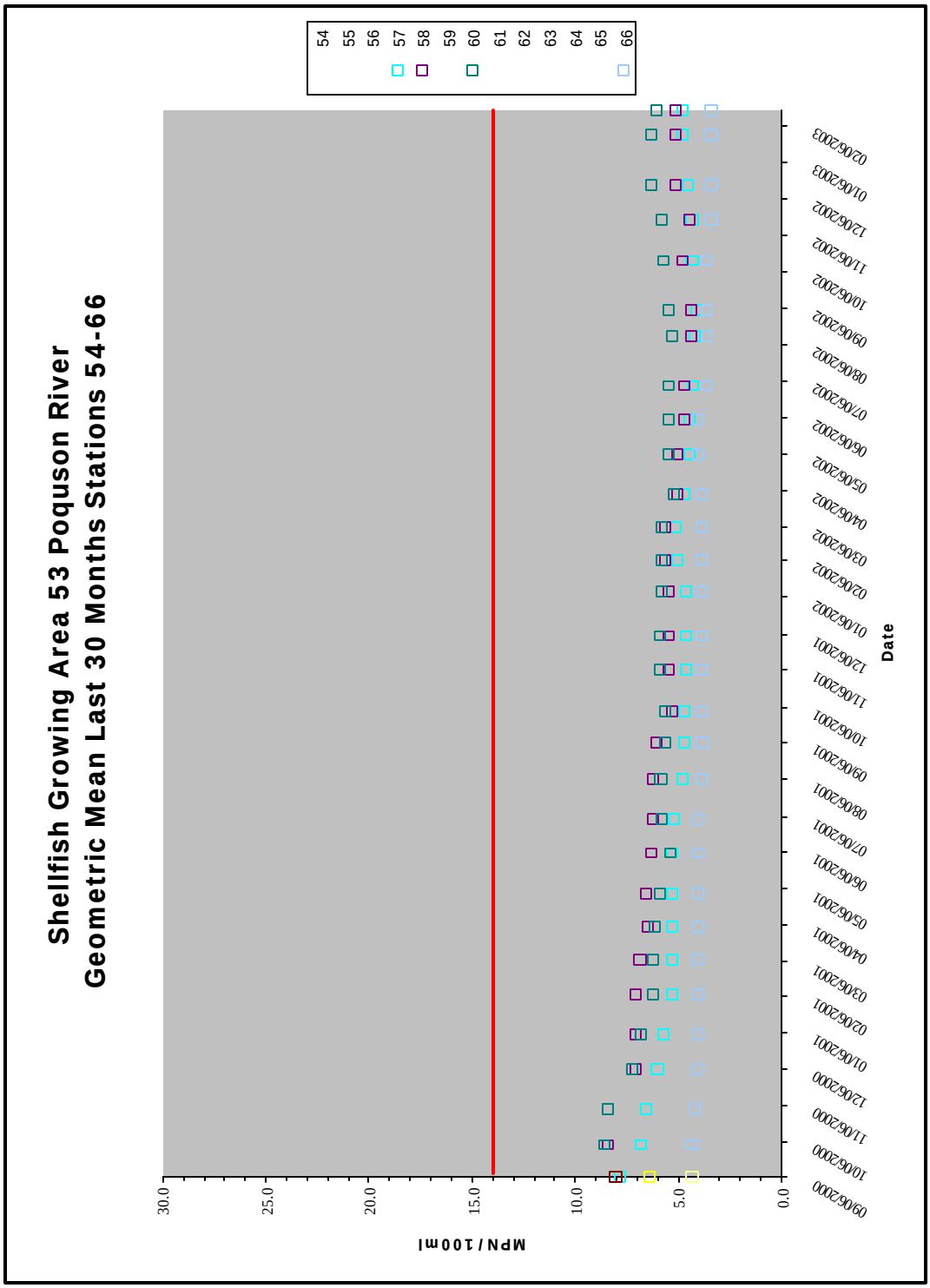

Shellfish Growing Area 53 Poquson River
Geometric Mean Last 30 Months Stations 54-66
54 55 56 57 58 59 60 61 62 63 64 65 66
MPN/100ml
30.0 25.0 20.0 15.0 10.0 5.0 0.0
Date
09/06/2000 10/06/2000 11/06/2000 12/06/2000 01/06/2001 02/06/2001 03/06/2001 04/06/2001 05/06/2001 06/06/2001 07/06/2001 08/06/2001 09/06/2001 10/06/2001 11/06/2001 12/06/2001 01/06/2002 02/06/2002 03/06/2002 04/06/2002 05/06/2002 06/06/2002 07/06/2002 08/06/2002 09/06/2002 10/06/2002 11/06/2002 12/06/2002 01/06/2003 02/06/2003

Figure 4.3D

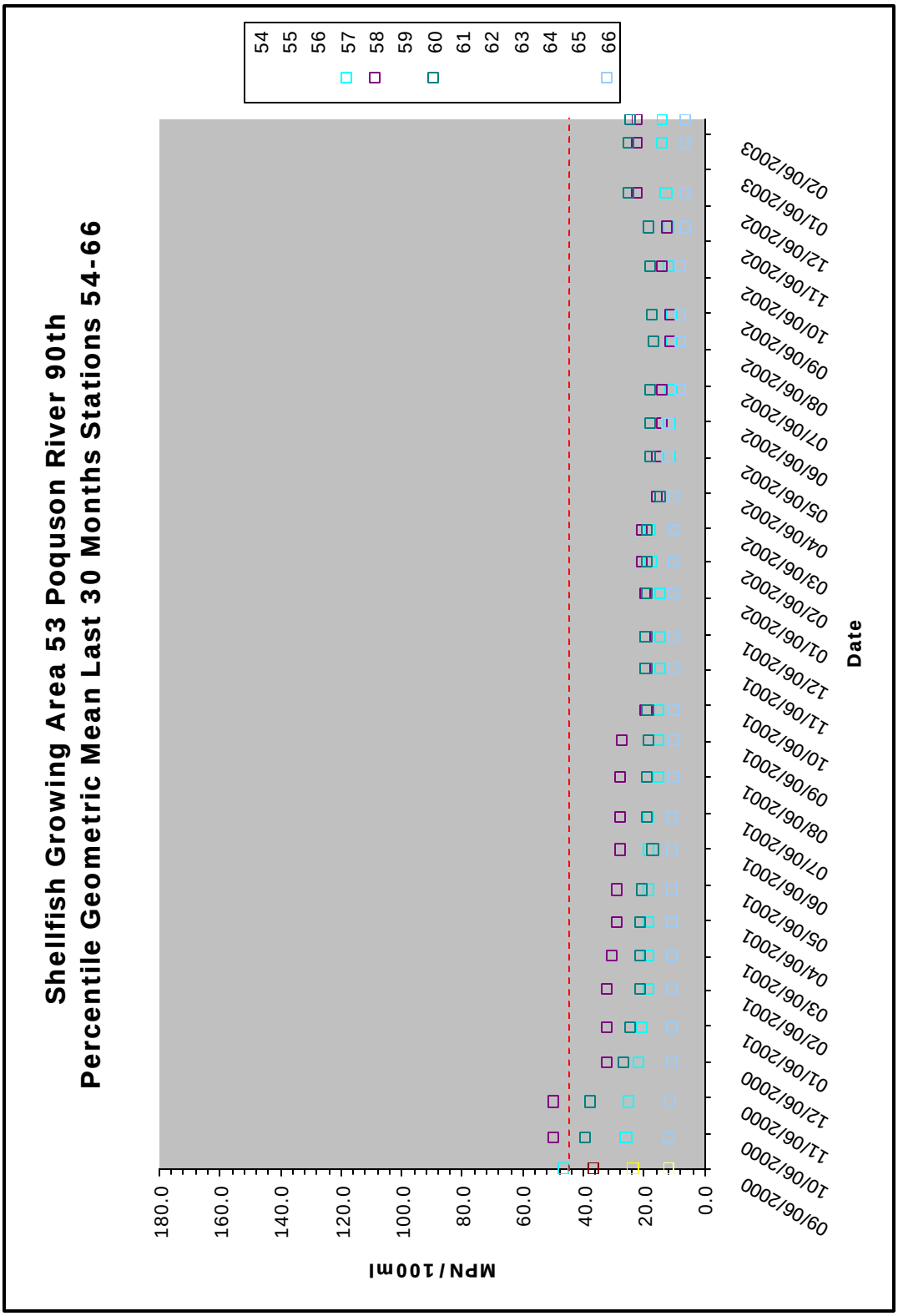
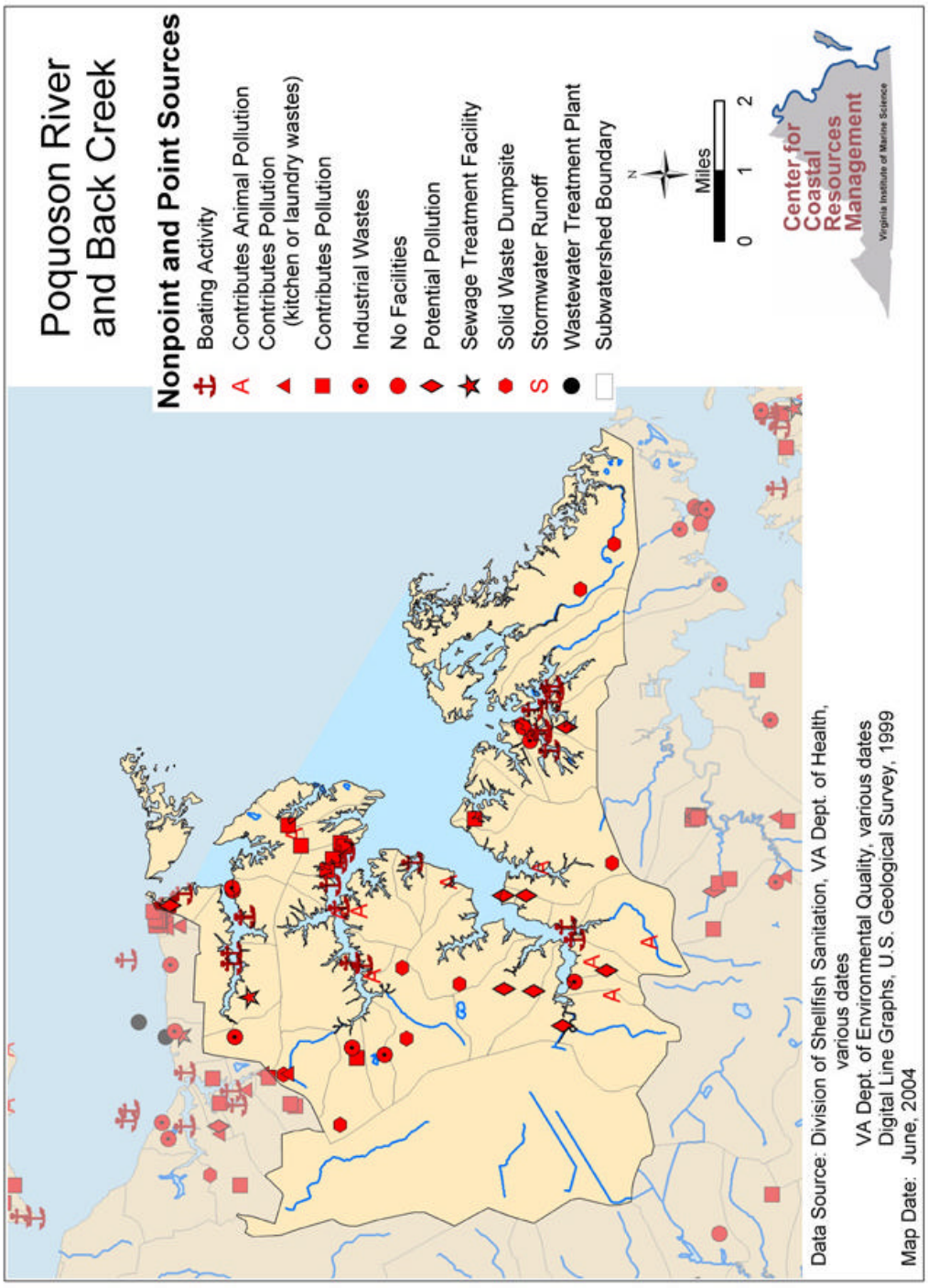

Shellfish Growing Area 53 Poquson River 90th
Percentile Geometric Mean Last 30 Months Stations 54-66
54 55 56 57 58 59 60 61 62 63 64 65 66
MPN/100ml
180.0 160.0 140.0 120.0 100.0 80.0 60.0 40.0 20.0 0.0
Date
09/06/2000 10/06/2000 11/06/2000 12/06/2000 01/06/2001 02/06/2001 03/06/2001 04/06/2001 05/06/2001 06/06/2001 07/06/2001 08/06/2001 09/06/2001 10/06/2001 11/06/2001 12/06/2001 01/06/2002 02/06/2002 03/06/2002 04/06/2002 05/06/2002 06/06/2002 07/06/2002 08/06/2002 09/06/2002 10/06/2002 11/06/2002 12/06/2002 01/06/2003 02/06/2003

Figure 4.4


Poquoson River and Back Creek
Nonpoint and Point Sources
Boating Activity
Contributes Animal Pollution
Contributes Pollution (kitchen or laundry wastes)
Contributes Pollution
Industrial Wastes
No Facilities
Potential Pollution
Sewage Treatment Facility
Solid Waste Dumpsite
Stormwater Runoff
Wastewater Treatment Plant
Subwatershed Boundary
N
Miles
0 1 2
Center for Coastal Resources Management
Virginia Institute of Marine Science
Data Source: Division of Shellfish Sanitation, VA Dept. of Health, various dates
VA Dept. of Environmental Quality, various dates
Digital Line Graphs, U.S. Geological Survey, 1999
Map Date: June, 2004

condemnation 137E the dominant sources were identified by the BST as livestock and wildlife followed by pets and human. RobertsCreek, condemnation 137F, showed wildlife and livestock as co-dominant followed by human and pets. Back creek, identified as condemnation 151 was principally dominated by livestock followed by humans with pets and wildlife at equal levels. Figures 4.5A through G show the mean distribution by month for the source categories and the annual means are shown in Figures 4.6A through G. The BST sampling period was October 2002 through August 2003. The target sampling interval was once monthly, if the graph does not show 11 months, that means that there were months for which data was not available. This data is shown in tabular form in Table 4.2. These values are used for the source allocation in deriving the Total Maximum Daily Loads for the Poquoson River Growing Area.

Figure 4.5A

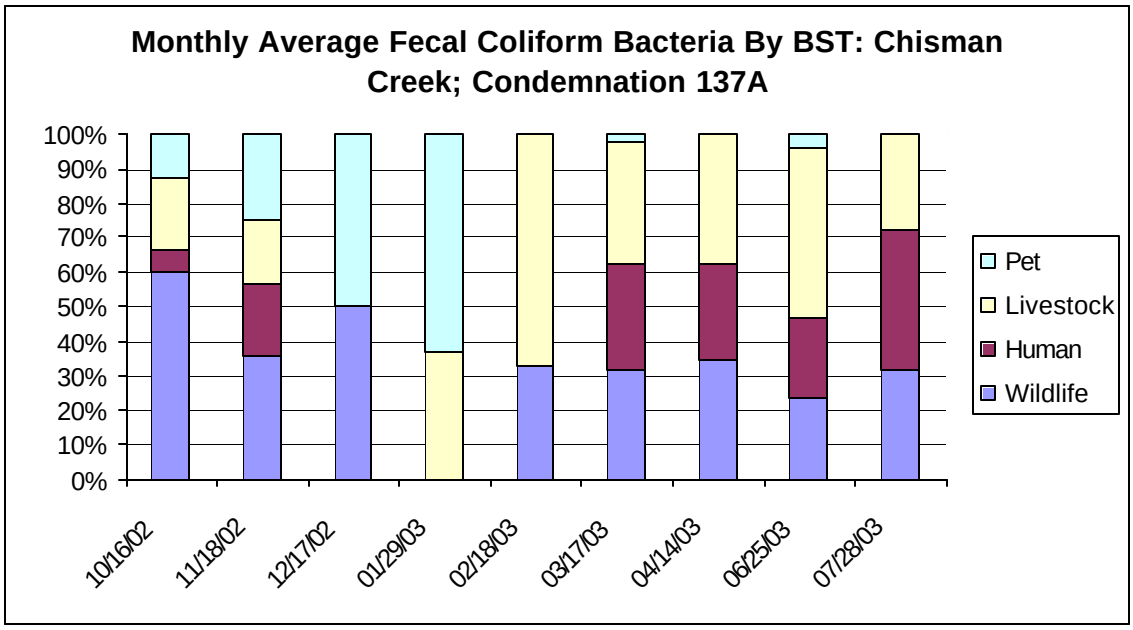


FIGURE 4.5B

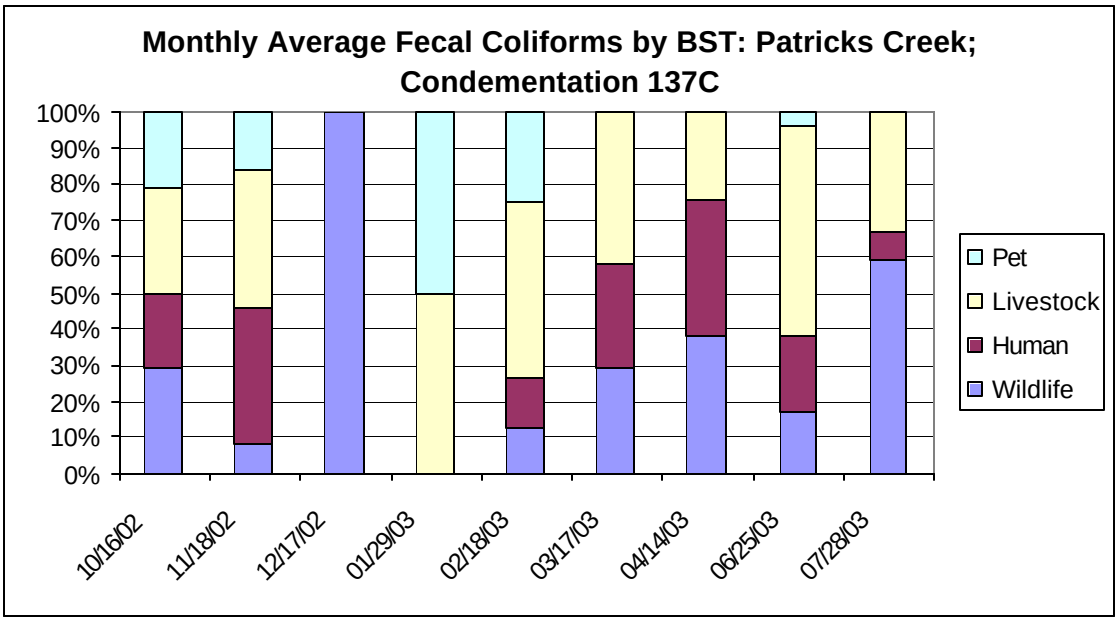


Figure 4.5C

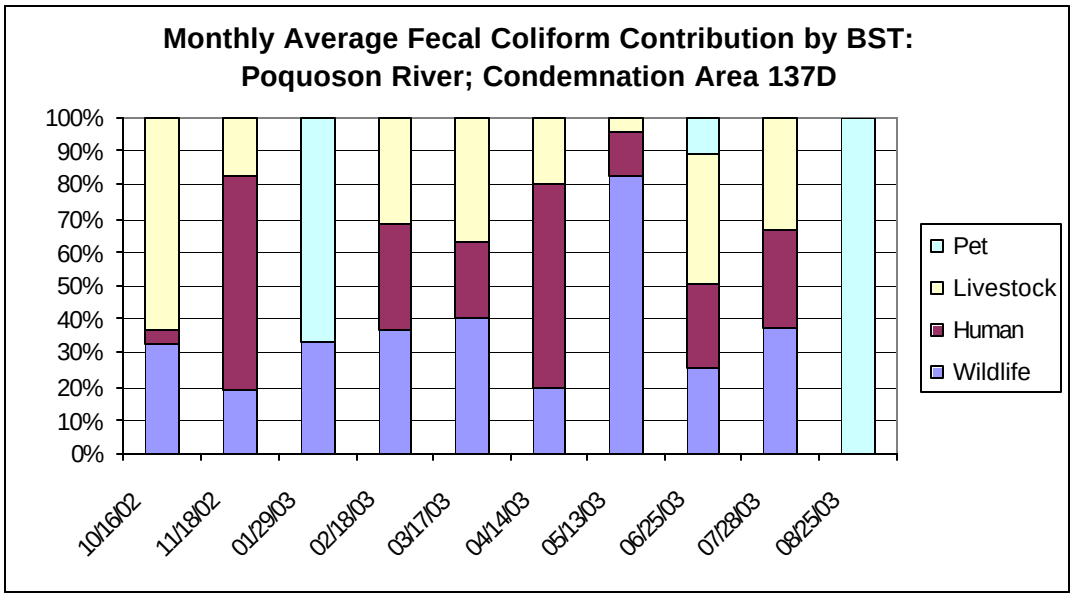


Figure 4.5 D

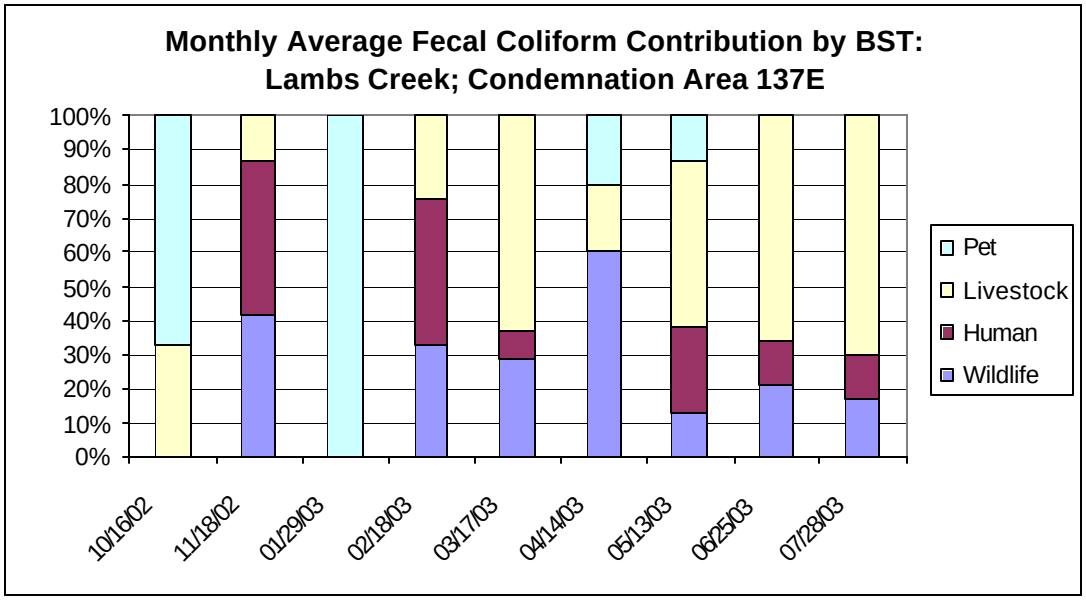


Figure4.5E

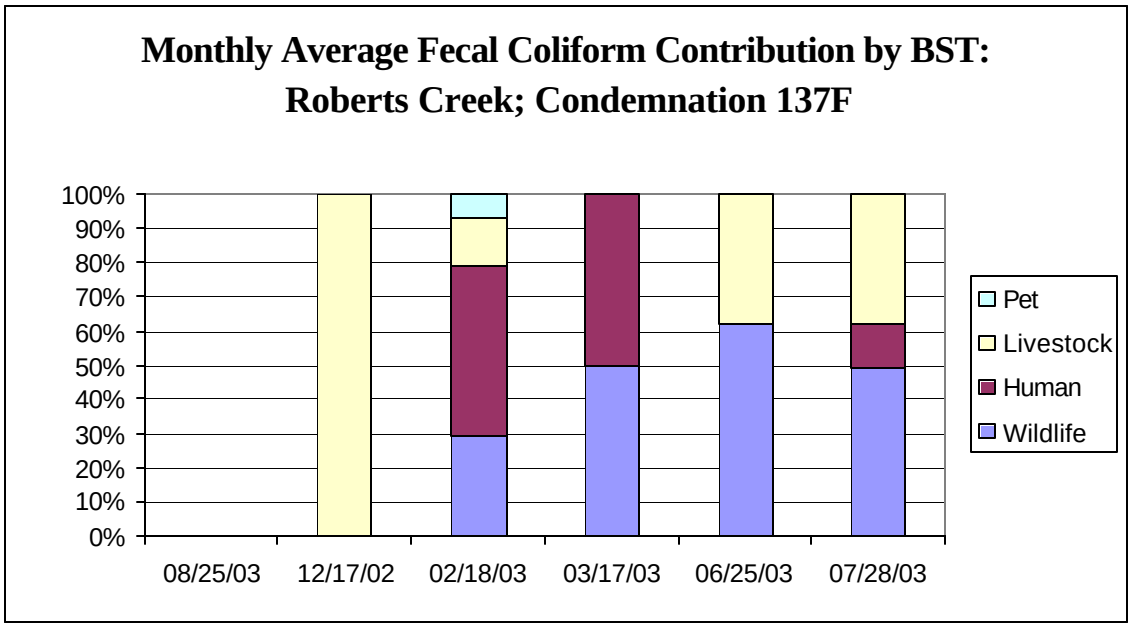


Figure 4.5F

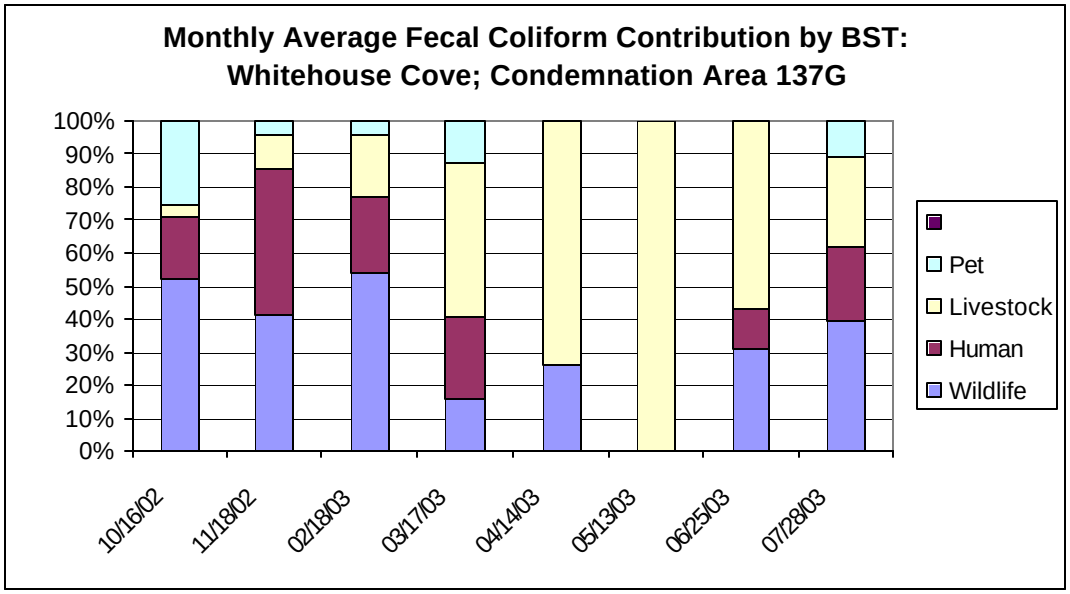


Figure 4.5G

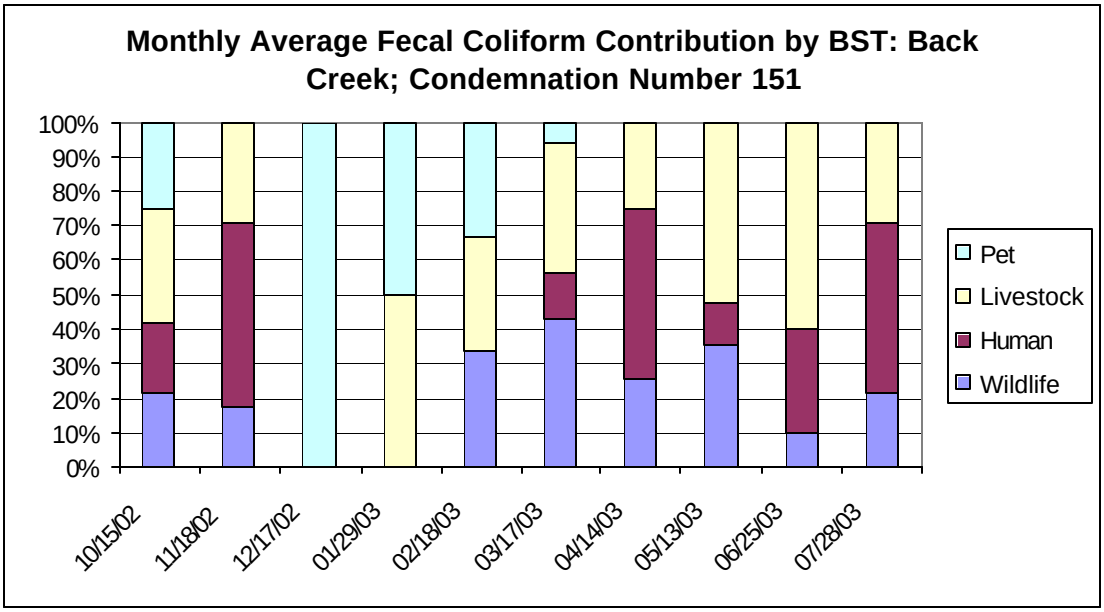


Figure 4.6 A

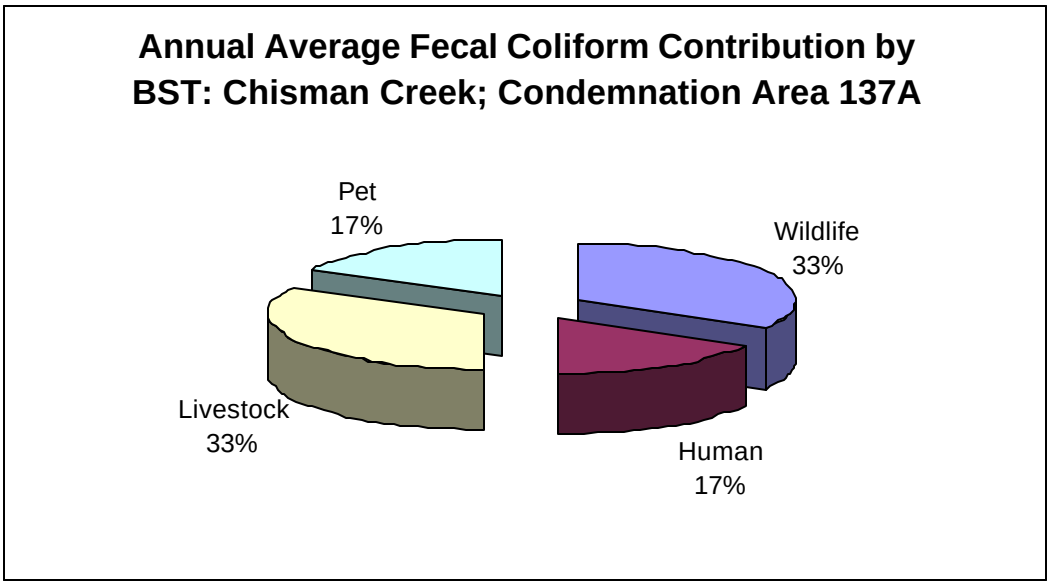


Figure 4.6 B

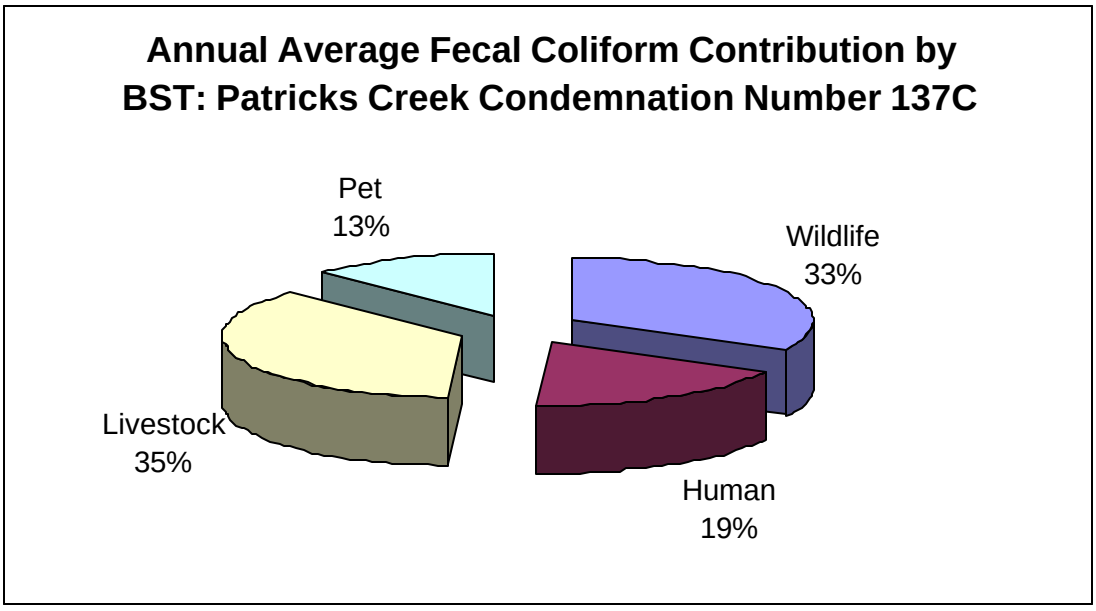


Figure 4.6 C

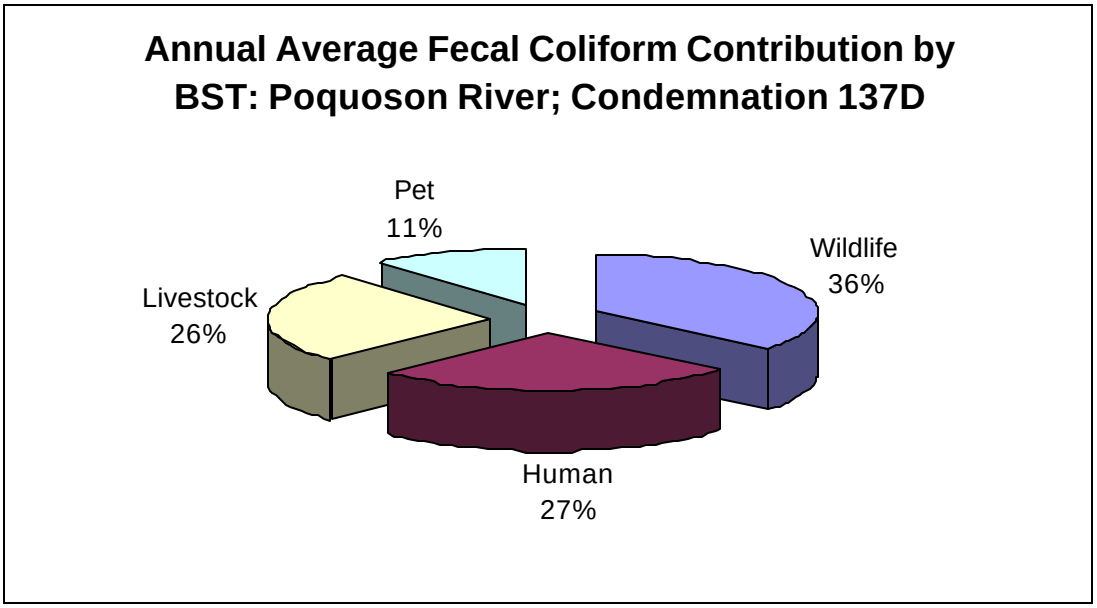


Figure 4.6 D

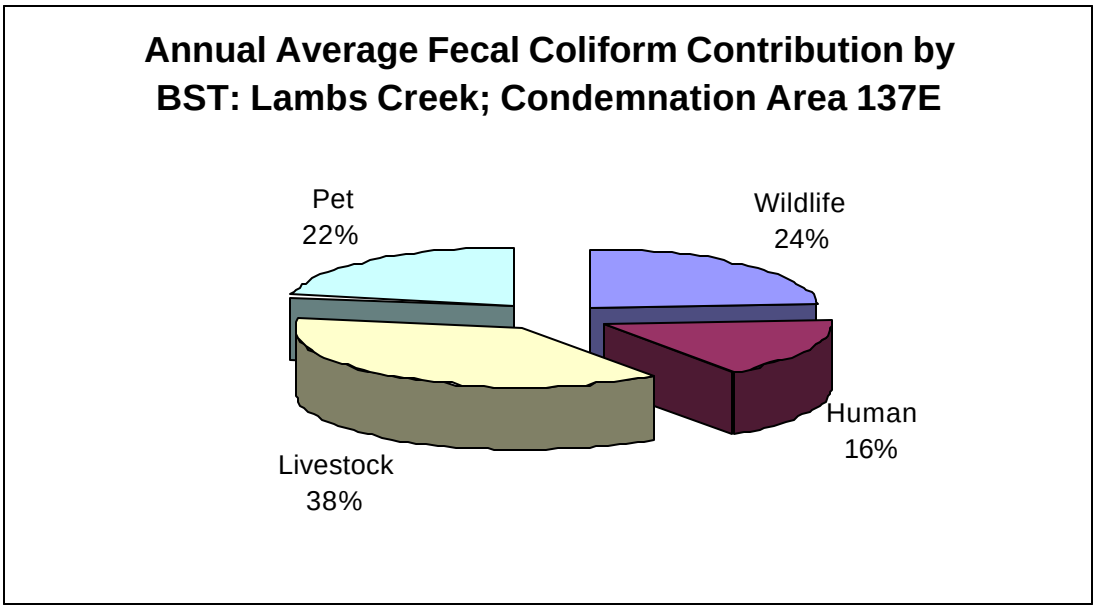


Figure 4.6 E

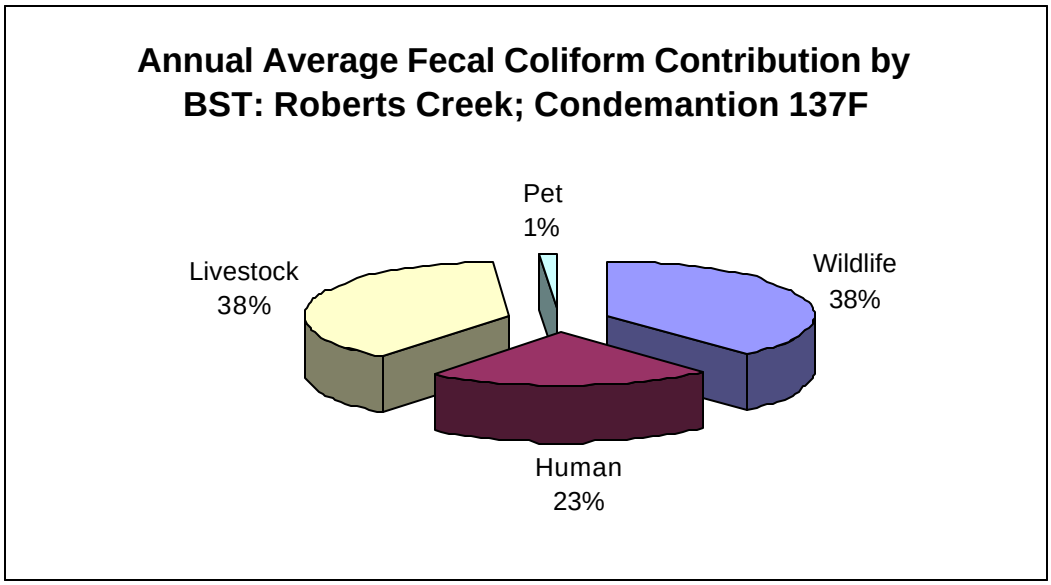


Figure 4.6 F

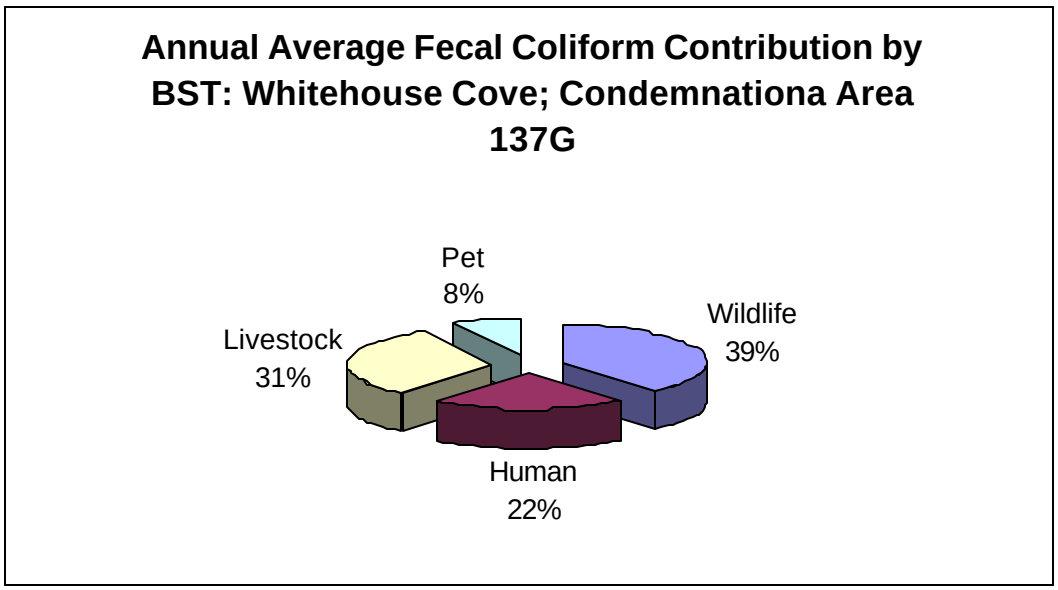


Figure 4.6 G

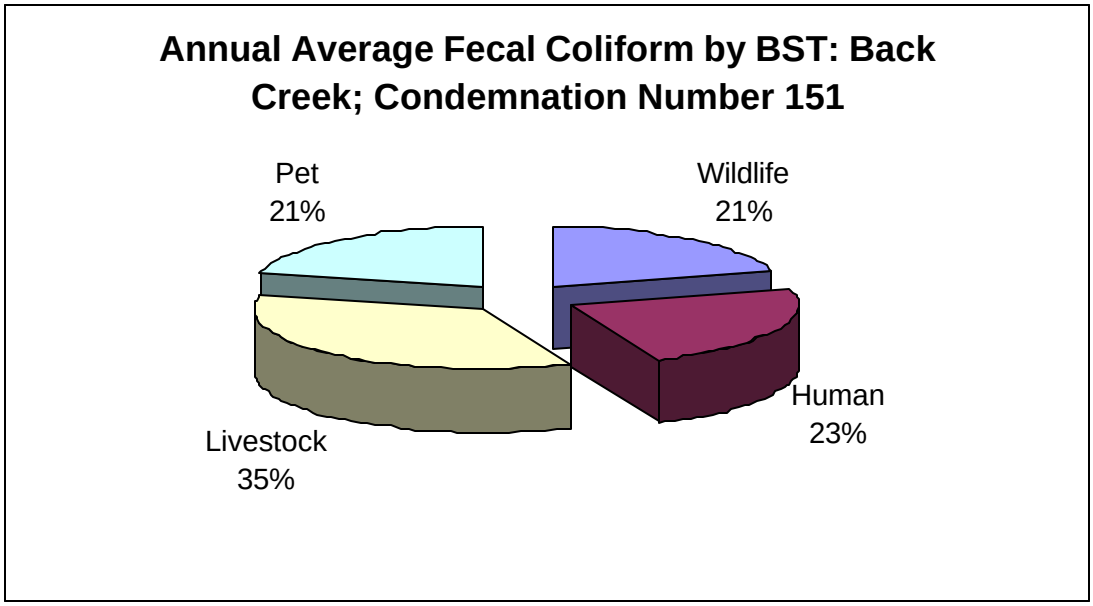


Table 4.2 Non-point Source Load Distribution using BST
Growing area 53: Poquoson River

Condemnation Area	Wildlife	Human	Livestock	Pet
137A Chisman Creek	33%	17%	33%	17%
137C Patricks Creek	33%	19%	36%	13%
137D Poquoson River	36%	27%	26%	11%
137E Lambs Creek	24%	16%	38%	22%
137 F Roberts Creek	38%	23%	38%	1%
(DELISTED) Lyons Creek	30%	33%	30%	8%
137G Whitehouse Creek	39%	22%	31%	8%
(DELISTED) Bennett Creek	30%	30%	28%	13%
(DELISTED) Eastern Cove	30%	34%	29%	7%
151 Back Creek	21%	23%	35%	21%

5.0 TMDL Development

5.1 Simplified Modeling Approach (Tidal Volumetric Model):

Personnel from EPA, Virginia DEQ, Virginia Department of Conservation and Recreation (DCR), Maryland Department of the Environment (MDE), Virginia DSS, Virginia Institute of Marine Sciences (VIMS), United States Geological Survey, Virginia Polytechnic University, James Madison University, and Tetra Tech composed the shellfish TMDL workgroup and developed a procedure for developing TMDLs using either a simplified approach to the development of the TMDL. The goal of the procedure is to use bacteriological source tracking (BST) data to determine the sources of fecal coliform violations and the load reductions needed to attain the applicable criteria.

5.2 The TMDL Calculation

To meet the water quality standards for both geometric mean and 90th percentile criteria, TMDLs for the impaired segments in the watershed are defined for the geometric mean load and the 90th percentile load. The TMDL for the geometric mean essentially represents the allowable average limit and the TMDL for the 90th percentile is the allowable upper limit. If observed data were available for more than one monitoring station in a condemned area, the volume-weighted values for each condemned area were used to represent the embayment concentration.

A. Current Fecal Coliform Condition

The fecal coliform concentration in an embayment varies due to the changes in biological, hydrological and meteorological conditions. The current condition was determined based on the 30-sample geometric mean and 90th percentile of volume-weighted fecal coliform values of each condemned area. The period of record for the monitoring data used to determine the current condition is 1995 to 2003. This interval was chosen to ensure inclusion of the data that represents the conditions at the time the waters were first listed as impaired in 1998. As the regulatory requirement for assessment is based upon 30 (month) sample intervals and the waters were first listed as impaired in 1998, the current condition has been determined using monitoring data for that time interval of 3 years preceding the 1998 list date to the time of the BST analysis. The maximum values for geometric mean and 90th percentile were used to represent the current loads. Therefore, the current loads represent the worse case scenario.

B. Geometric Mean Analysis:

The current 30-sample geometric mean was used for the load estimation. The corresponding 30-sample geometric mean from the station outside the condemned area was used as the boundary condition. The current load was estimated using steady state tidal prism model. The allowable load was calculated using the water quality standard of 14 MPN/100ml. This value was also used as boundary condition for the calculation. The load reduction needed for the attainment of the water quality standard was determined by subtracting the allowable load from the current load. The process may be described by the word equation as follows. The calculated results are listed in table 5-2.

The load reduction is estimated as follows:

Geometric Mean Value (X MPN/100ml) x (volume) = Existing Load

Criteria Value (14 MPN/100ml) x (volume) = Allowable Load

$$\text{Load Reduction} = \frac{\text{Current Load} - \text{Allowable Load}}{\text{Current Load}} \times 100\ \%$$

Table 5.1 Geometric Mean Analysis of Current Load and Estimated Load Reduction

Condemnation Area	Volume (m^3)	Fecal Coliform (MPN/100ml)	Water Quality Standard (MPN/100ml)	Current Load (MPN/day)	Allowable Load (MPN/day)	Required Reduction (%)
137A Chisman Creek	946800	23.1	14	2.19E+11	1.33E+11	39%
137B Unamed Cove	2346	34.6	14	8.11E+08	3.28E+08	82%
137C Patricks Creek	86760	34.4	14	6.86E+10	1.21E+10	82%
137D Poquoson River	430830	23.4	14	1.01E+11	6.03E+10	40%
137E Lambs Creek	143460	27.6	14	3.95E+10	2.01E+10	49%
137 F Roberts Creek	35280	12.1	14	4.28E+09	4.94E+09	0%
(Delisted in 2004 relisted 2005) Lyons Creek	83250	10.6	14	8.80E+09	1.17E+10	0%
137G Whitehouse Creek	174240	24.4	14	4.26E+10	2.44E+10	43%
(Delisted in 2004 relisted 2005) Bennett Creek	30420	11.4	14	3.48E+09	4.26E+09	0%
(Delisted in 2004 relisted 2005) Eastern Cove	40410	11.8	14	4.79E+09	5.66E+09	0%
151 Back Creek	512190	14.1	14	7.21E+10	7.17E+10	1%

C. 90th Percentile Analysis

The current 30-sample 90th percentile concentration was used for load estimation. The corresponding 30-sample geometric mean from the station outside the condemned area was used as the boundary condition. The current load was estimated using the simplified volumetric tidal model. The allowable load was calculated based on the water quality standard of 49 MPN/100ml. This value was also used as boundary condition for the calculation. The calculated results are listed in Table 5-3.

The load reduction is estimated as follows:

$$\text{Load Reduction} = \frac{\text{Current Load} - \text{Allowable Load}}{\text{Current Load}} \times 100\ \%$$

Table 5.2 90th Percentile Analysis of Current Load and Estimated Load Reduction

Condemnation Area	Volume (m^3)	Fecal Coliform (MPN/100ml)	Water Quality Standard (MPN/100ml)	Current Load (MPN/day)	Allowable Load (MPN/day)	Required Reduction (%)
137A Chisman Creek	946800	182.8	49	1.73E+12	4.64E+11	73%
137B Unamed Cove	2346	316.8	49	7.43E+09	1.15E+09	85%
137C Patricks Creek	86760	249.6	49	6.86E+10	4.25E+10	38%
137D Poquoson River	430830	148.9	49	6.42E+11	2.11E+11	67%
137E Lambs Creek	143460	203.4	49	2.92E+11	7.03E+10	76%
137 F Roberts Creek	35280	96.2	49	3.39E+10	1.73E+10	49%
(Delisted in 2004 relisted 2005) Lyons Creek	83250	62.9	49	5.24E+10	4.08E+10	22%
137G Whitehouse Creek	174240	186.9	49	3.26E+11	8.54E+10	74%
(Delisted in 2004 relisted 2005) Bennett Creek	30420	64.7	49	1.97E+10	1.49E+10	24%
(Delisted in 2004 relisted 2005) Eastern Cove	40410	64.9	49	2.62E+10	1.98E+10	24%
151 Back Creek	512190	91.7	49	4.70E+11	2.51E+11	47%

D. Recreational Impairment Analysis

Two water quality standards operate in salt water areas with regard to recreation use, the fecal coliform standard, which is a transitional standard that expires on June 30, 2008, and the *enterococci* standard which is applied concurrently. Because more than 12 *enterococci* samples exist in this watershed the *enterococci* standard supercedes the fecal coliform standard for recreational use.

The recreational use load for the upper Poquoson River Creek and its tributaries is estimated volumetricly by the following equation:

Max. Single highest *enterococci* value x volume = *enterococci* load

The load reduction for each standard is calculated utilizing a similar approach as used for the shellfish reductions:

$$\text{Load reduction} = \frac{\text{current load}_{max} - \text{allowable load}}{\text{currentload}_{max}}$$

The results for these calculations is shown in Table 5.3 .

Table 5.3 Calculations for Recreation Use Impairments in Upper Poquoson River

Impaired Area	Volume (m^3)	Bacteria Pollutant	Current Load (cfu/day)	Allowable Load (cfu/day)	Required Reduction (%)
VAT-C07E-04 Poquoson River, Upper	**430830**	***enterococci***	**3.54E+13**	**4.48E+11**	**99%**

5.3 Load Allocation

A comparison of the reductions based on geometric mean load and on the 90th percentile load shows that the 90th percentile load is the critical condition. This is consistent with water quality analysis. The 90th percentile criterion is most frequently exceeded for all shellfish waters except where the *enterococci* impairment occurred in the upper Poquoson River watershed. Therefore the 90th percentile loading is used to allocate source contributions and establish load reduction targets among the various contributing sources that will yield the necessary water quality improvements to attain the water quality standard for shellfish waters. The *enterococci* impairment in the upper Poquoson river required a 99% reduction in watershed loading to achieve water quality standards. This exceeded the 67% reduction in loading required from the shellfish fecal coliform standard, therefore the more stringent *enterococci* loading reduction target is the more appropriate to ensure that water quality criterion for both constituents is achieved.

Based on source assessment of the watershed, the percent loading for each of the major source categories is estimated. These percentages are used to determine where load reductions are needed. The loadings for each source are determined by multiplying the total current and allowable loads by the representative percentage. The percent reduction needed to attain the water quality standard or criterion is allocated to each source category. This is shown in Table 5-4 and serves to fulfill the TMDL requirements by ensuring that the criterion is attained.

Table 5.4 Reduction and Allocation Based Upon 90th Percentile Standard: Growing Area 53

Condemnation Area	Source	BST Allocation % of Total Load	Current Load MPN/ day	Total Load Allocation MPN/ day	Reduction Needed
137A Chisman Creek	Wildlife	33%	5.71E+11	4.64E+11	19%
	Human	17%	2.94E+11	0.00E+00	100%
	Livestock	33%	5.71E+11	0.00E+00	100%
	Pets	17%	2.94E+11	0.00E+00	100%
	Total	**100%**	**1.73E+12**	**4.64E+11**	**38%**
137B* Un-named Cove at Patricks Creek (added in 2004)	Wildlife	36%	2.45E+09	1.15E+09	53%
	Human	27%	1.26E+09	0.00E+00	100%
	Livestock	26%	2.45E+09	0.00E+00	100%
	Pets	11%	1.26E+09	0.00E+00	100%
	Total	**100%**	**7.43E+09**	**1.15E+09**	**85%**
137C Patricks Creek	Wildlife	36%	2.26E+10	2.26E+10	0%
	Human	27%	1.30E+10	0.00E+00	100%
	Livestock	26%	2.47E+10	1.10E+10	56%
	Pets	11%	8.92E+09	8.92E+09	0%
	Total	**100%**	**6.86E+10**	**4.25E+10**	**38%**
137D Poquoson River	Wildlife	24%	2.31E+11	2.11E+11	9%
	Human	16%	1.73E+11	0.00E+00	100%
	Livestock	38%	1.67E+11	0.00E+00	100%
	Pets	22%	7.06E+10	0.00E+00	100%
	Total	**100%**	**6.42E+11**	**2.11E+11**	**50%**
137E Lambs Creek	Wildlife	24%	7.00E+10	7.00E+10	0%
	Human	16%	4.67E+10	0.00E+00	100%
	Livestock	38%	1.11E+11	0.00E+00	100%
	Pets	22%	6.42E+10	2.57E+08	100%
	Total	100%	**2.92E+11**	**7.03E+10**	**63%**
137F Roberts Creek	Wildlife	38%	1.29E+10	1.29E+10	0%
	Human	23%	7.81E+09	0.00E+00	100%
	Livestock	38%	1.29E+10	4.38E+09	66%
	Pets	1%	3.39E+08	0.00E+00	100%
	Total	100%	**3.39E+10**	**1.73E+10**	**49%**
(DELISTED) Lyons Creek	Wildlife	30%	1.57E+10	1.57E+10	0%
	Human	33%	1.73E+10	5.18E+09	70%
	Livestock	30%	1.57E+10	1.57E+10	0%
	Pets	8%	4.19E+09	4.19E+09	0%
	Total	100%	**5.24E+10**	**4.08E+10**	**22%**

Table 5.4 Reduction and Allocation Based Upon 90th Percentile Standard: Growing Area 53

Condemnation Area	Source	BST Allocation % of Total Load	Current Load MPN/ day	Total Load Allocation MPN/ day	Percent Reduction Needed
137G White-house Creek	Wildlife	39%	1.27E+11	8.54E+10	33%
	Human	22%	7.16E+10	0.00E+00	100%
	Livestock	31%	1.01E+11	0.00E+00	100%
	Pets	8%	2.61E+10	0.00E+00	100%
	Total	**100%**	**3.26E+11**	**8.54E+10**	**60%**
(DELISTED) Bennett Creek	Wildlife	30%	5.90E+09	5.90E+09	0%
	Human	30%	5.90E+09	8.86E+08	85%
	Livestock	28%	5.51E+09	5.51E+09	0%
	Pets	13%	2.56E+09	2.56E+09	0%
	Total	100%	**1.97E+10**	**1.49E+10**	**24%**
(DELISTED) Eastern Cove	Wildlife	30%	8.73E+09	8.73E+09	0%
	Human	34%	9.89E+09	5.94E+08	94%
	Livestock	29%	8.44E+09	8.44E+09	0%
	Pets	7%	2.04E+09	2.04E+09	0%
	Total	**100%**	**2.91E+10**	**1.98E+10**	**32%**
151 Back Creek	Wildlife	21%	21%	9.86E+10	9.86E+10
	Human	23%	23%	2.62E+10	0.00E+00
	Livestock	35%	35%	1.64E+11	5.34E+10
	Pets	21%	21%	9.86E+10	9.86E+10
	Total	**100%**	**1.00E+02**	**4.70E+11**	**2.51E+11**

The TMDL seeks to eliminate 100% of the human derived fecal component regardless of the allowable load determined through the load allocation process. Human derived fecal coliforms are a serious concern in the estuarine environment and discharge of human waste is precluded by state and federal law. According to the preceding analysis, reduction of the controllable loads; human, livestock and pets, will not result in achievement of the water quality standard for the condemned areas. Absent any other sources, the reduction is allocated to wildlife. Through an iterative implementation of actions to reduce the controllable loads, subsequent monitoring may indicate that further reductions are not necessary, or that revisions in implementation strategies may be appropriate. Continued violations may result in the process of Use Attainment Analysis, UAA, for the waterbody (see Chapter 6 for a discussion of UAA). The allocations presented demonstrate how the TMDLs could be implemented to achieve water quality standards; however, the state reserves the right to allocate differently, as long as consistency with the achievement of water quality standards is maintained.

5.3.1 Development of Wasteload Allocations

Contributions of pollutants which arrive in a natural system through man-made treatment works such as waste water treatment plants and storm water management systems which are regulated by a VPDES permit constitute a separate load to the system that is considered differently than contributions from wildlife and birds that arrive via more diffuse pathways. This source of loading from anthropogenic sources like these is termed a waste load allocation (WLA) and is the sum of all man-made sources which are regulated under § 402 of the Clean Water Act by the Department of Environmental Quality under the Virginia Pollutant Discharge Elimination System (VPDES). The relationship to the total load allocation (TLA) and load allocation (LA) is shown below:

Waste Load Allocation (WLA) = (permitted limit for bacteria) x (permitted maximum daily discharge volume)

For the permitted fecal coliform and *enterococci* limits this calculation is as follows:

(1) **WLA fecal coliform =** $\frac{\text{(49 mpn) x (vol. discharge)}}{\text{100 ml}}$

WLA fecal coliform = MPN fecal coliform/day

(2) **WLA *enterococci* =** $\frac{\text{(104) x (vol. discharge)}}{\text{100 ml}}$

WLA *enterococci* = c.f.u. *enterococci*/day

Total Load Allocation = Waste Load Allocation (WLA) + 5%MOA + Load Allocation (LA)

Because we have no means of measuring discharge volume from a storm water system, a simple but useful approach in urbanized systems such as the City of Poquoson and surrounding York County is to adopt an weighted mean approach based upon land use and known average impervious area by land use type. This is the approach adopted in this TMDL. Table 5-5 shows the land use in the watershed and the percent impervious area by land use type

Weighted mean or weighted average is calculated as follows:

$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}$$

Or

$$\bar{x} = \frac{w_1 x_1 + w_2 x_2 + w_3 x_3 + \ldots + w_n x_n}{w_1 + w_2 + w_3 + \ldots + w_n}$$

Where:

x_n is a given data value
w_n is the weight of that value

Within each sub-watershed that contains an impaired segment, weight averaging the percent impervious area by land use type yields an impervious area specific to each sub-watershed. The results of these analyses are shown in Figures 5.0 through 5.6. Utilizing this method the waste load allocation is arrived at by attributing the derived percentage of impervious area, less the wetland and waters component, to the storm water system permitted under the Virginia Pollutant Discharge Elimination System (VPDES) in the Poquoson Drainage. This is assumed to be reflective of the contribution of the impervious area in the entire watershed. The WLA is subtracted from the total load allocation (TLA) to yield the load allocation attributable to background sources.

The waste load allocation is then determined using the following formula:

Waste Load Allocation (WLA) for a Tributary = x % of the Total Load Allocation for Trib.

WLA = (TLA) * x%

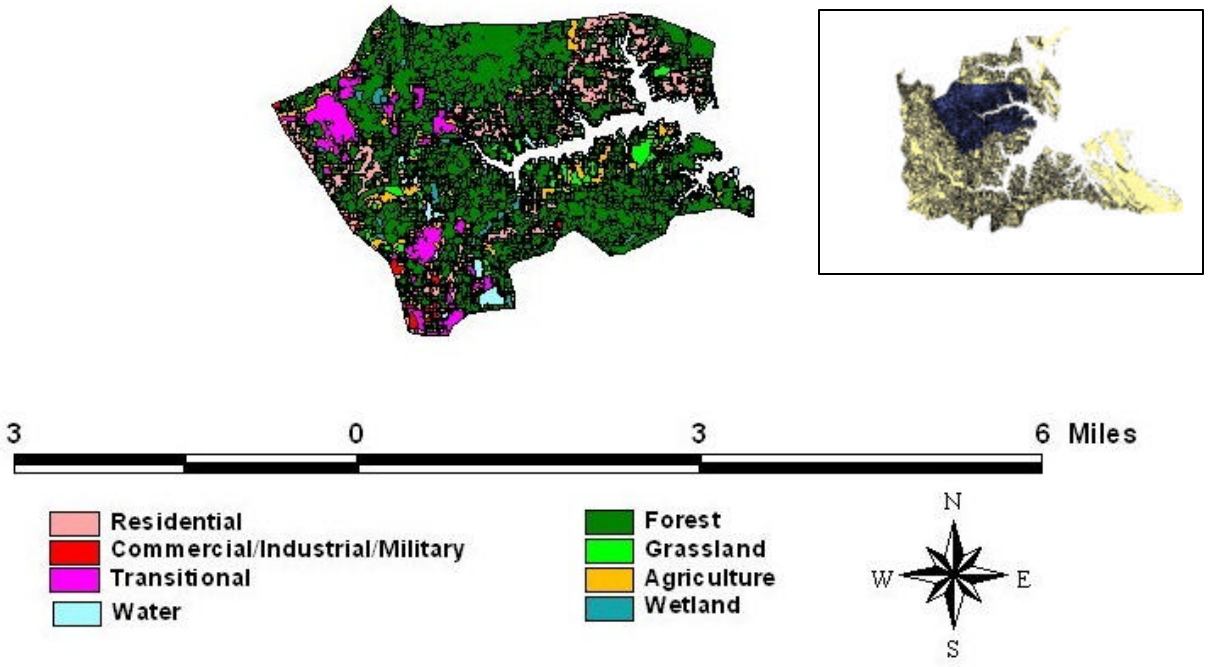
5.4 Consideration of Critical Conditions and Seasonal Variation

EPA regulations at 40 CFR 130.7 (c)(1) require TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the waterbody is protected during times when they are most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards. The current loading to the waterbody was determined using a long-term record of water quality monitoring (observation) data. The period of record for the data was 1995 to 2003. The resulting estimate is quite robust.

A comparison of the geometric mean values and the 90th percentile values against the water quality criteria will determine which represents the more critical condition or higher percent reduction. If the geometric mean values dictate the higher reduction, this suggests that, on average, water sample counts are consistently high with limited variation around the mean. If the 90th percentile criterion requires a higher reduction, this suggests an occurrence of the high fecal coliform due to the variation of hydrological conditions. For this study, the 90th percentile criterion is the most critical condition for the shellfish standard. Thus, the final load reductions determined using the 90th percentile represent the most stringent conditions and it is the reductions based on these bacterial loadings that will yield attainment of the shellfish water quality criteria. Seasonal variations involve changes in surface runoff, stream flow, and water quality as a result of hydrologic and climatologic patterns. Variations due to changes in the hydrologic cycle as well as temporal variability in fecal coliform sources, such as migrating duck and goose populations are accounted for by the use of the long-term data record to estimate the current load.

Figure 5.0
Chisman Creek Watershed Land Use

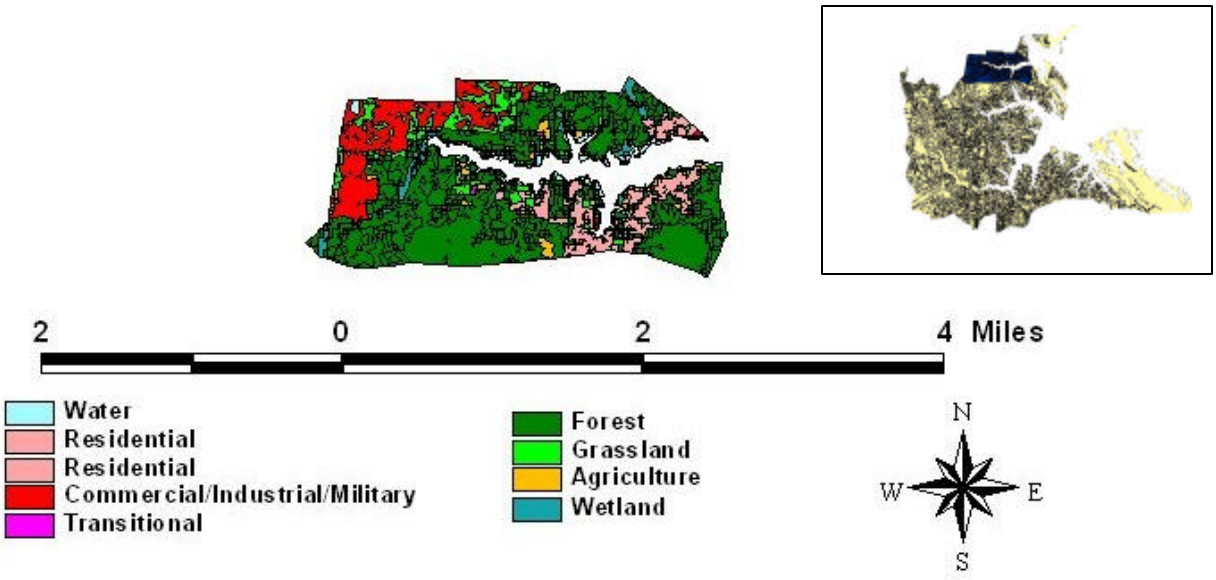


Chisman Creek Impervious Area Calculation by Land Use Type

Impervious area (weight factor)	Acres	Weight x Acres
2% impervious	**2061.5**	**41.2**
9% Impervious	**94.7**	**8.5**
20% Impervious	**272.3**	**54.5**
70% Impervious	**127.7**	**89.4**
Watershed Totals	**2556.2**	**193.6**

Impervious Area = $\frac{\text{(\%IMPERVIOUS)*(Acres of Impervious Type)}}{\text{Total watershed acres (less water and wetlands)}} =$ **8%**

Figure 5.1
Back Creek Watershed Land Use

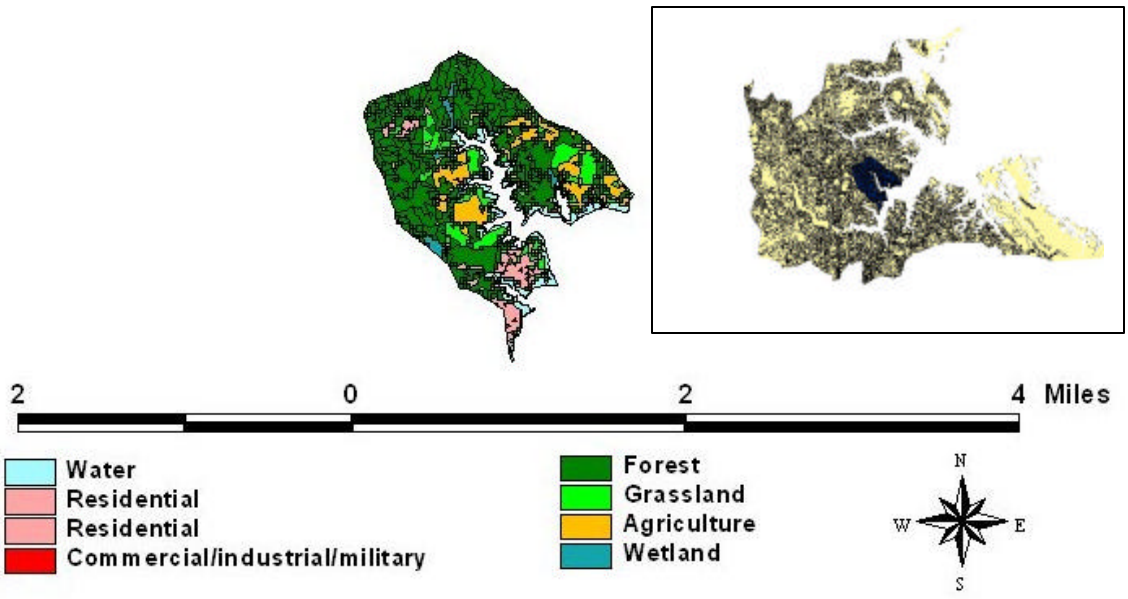


Back Creek Impervious Area Calculation by Land Use Type

Impervious area (weight factor)	Acres	Weight x Acres
2% impervious	**632.6**	**12.7**
9% Impervious	**13.2**	**1.2**
20% Impervious	**76.3**	**15.3**
70% Impervious	**59.4**	**41.6**
Watershed Totals	**781.6**	**70.7**

Impervious Area = (%IMPERVIOUS)*(Acres of Impervious Type)
Total watershed acres (less water and wetlands) = 9%

Figure 5.2
Patricks Creek with Un-named Tributary Watershed Land Use

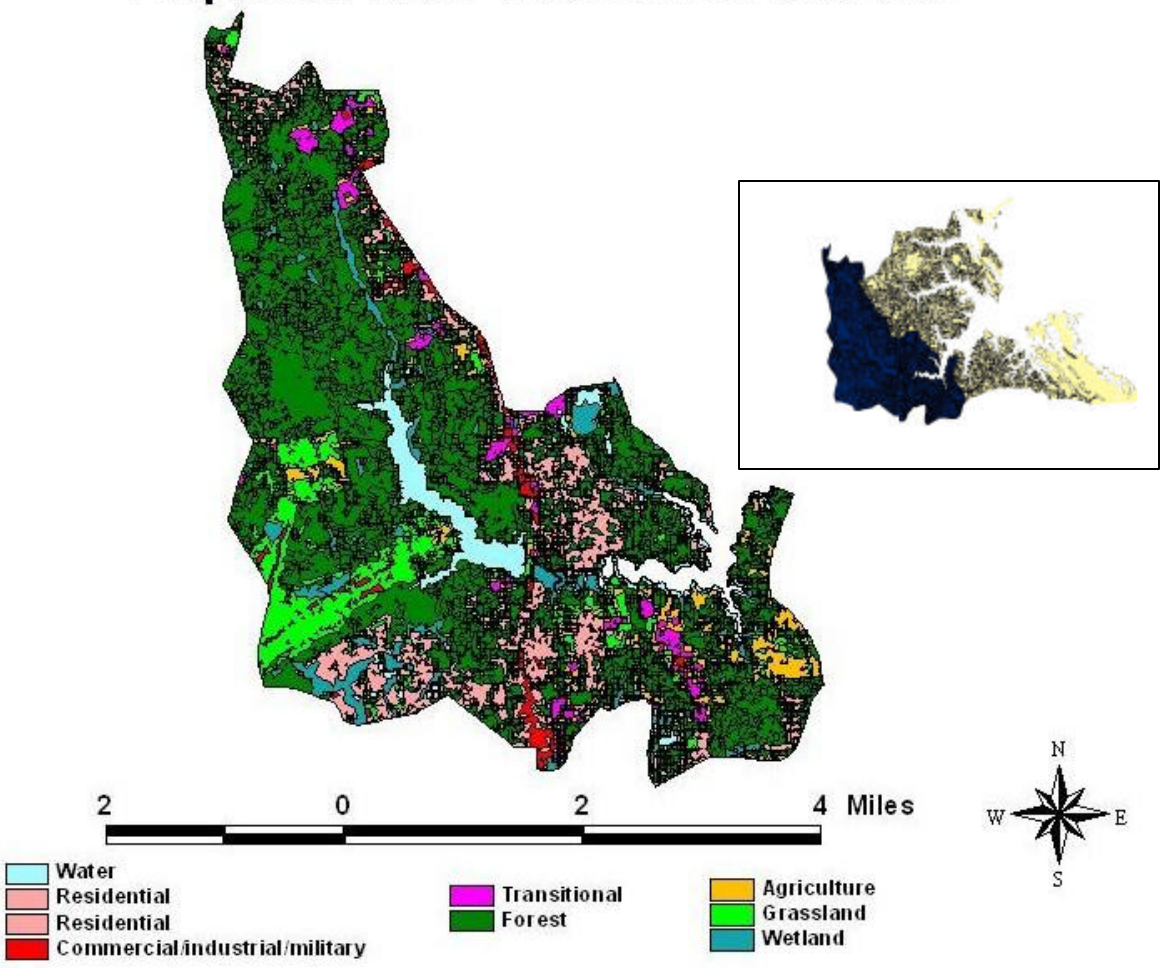


Patricks Creek Impervious Area Calculation by Land Use Type

Impervious area (weight factor)	Acres	Weight x Acres
2% impervious	**469.0**	**9.4**
9% Impervious	**0.0**	**0.0**
20% Impervious	**19.1**	**3.8**
70% Impervious	**20.5**	**14.4**
Watershed Totals	**508.6**	**27.6**

Impervious Area = **(%IMPERVIOUS)*(Acres of Impervious Type)**
Total watershed acres (less water and wetlands) = 5%

Figure 5.3
Poquoson River Watershed Land Use

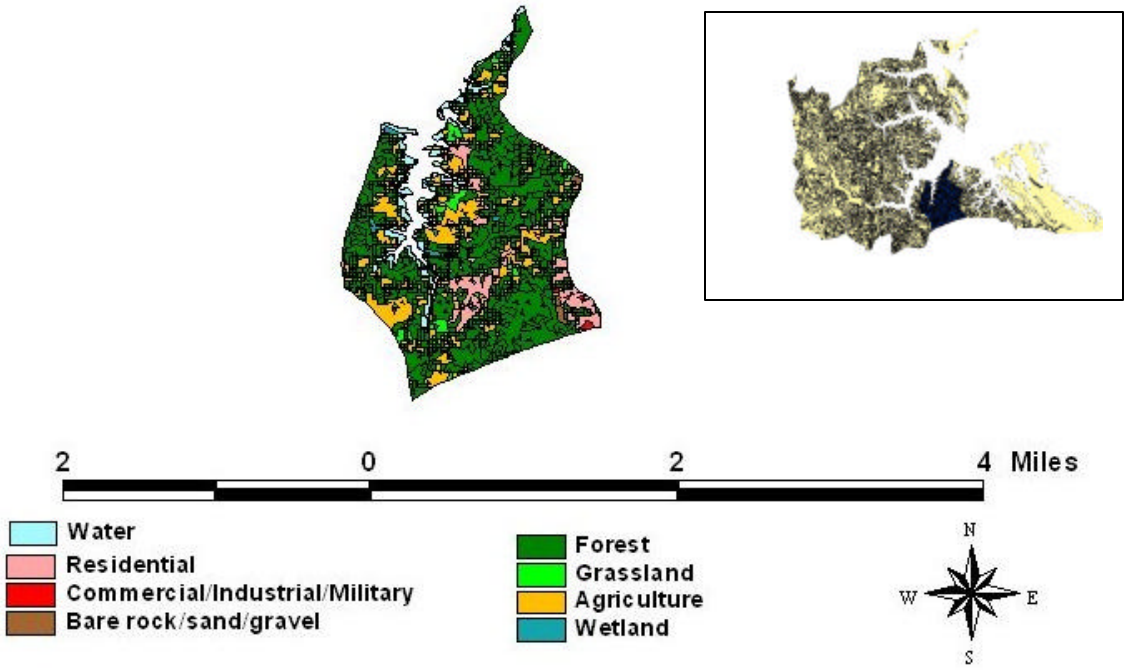


Poquoson River Impervious Area Calculation by Land Use Type

Impervious area (weight factor)	Acres	Weight x Acres
2% impervious	**3944.8**	**78.9**
9% Impervious	**186.4**	**16.8**
20% Impervious	**519.6**	**103.9**
70% Impervious	**229.7**	**160.8**
Watershed Totals	**4880.5**	**360.4**

Impervious Area = **(%IMPERVIOUS)*(Acres of Impervious Type)**
Total watershed acres (less water and wetlands) = 7%

Figure 5.4
Lambs Creek Watershed Land Use

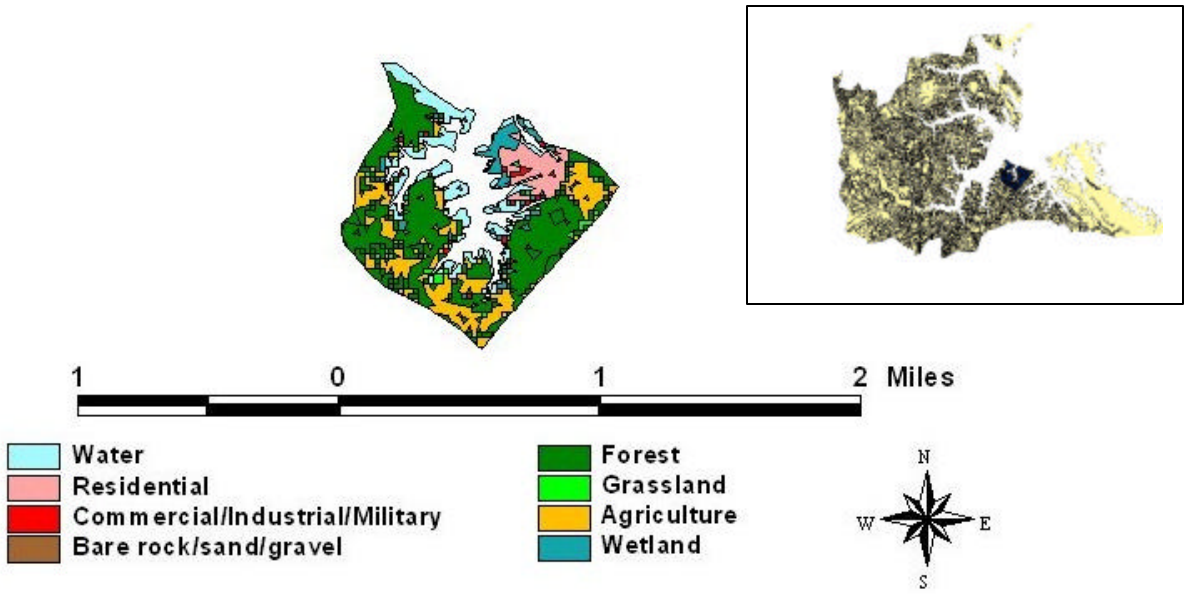


Lambs Creek Impervious Area Calculation by Land Use Type

Impervious area (weight factor)	Acres	Weight x Acres
2% impervious	**804.4**	**16.1**
9% Impervious	**7.3**	**0.7**
20% Impervious	**76.3**	**15.3**
70% Impervious	**19.8**	**13.9**
Watershed Totals	**907.8**	**45.9**

Impervious Area = $\frac{\text{(\%IMPERVIOUS)*(Acres of Impervious Type)}}{\text{Total watershed acres (less water and wetlands)}} = 5\%$

Figure 5.5
Roberts Creek Watershed Land Use

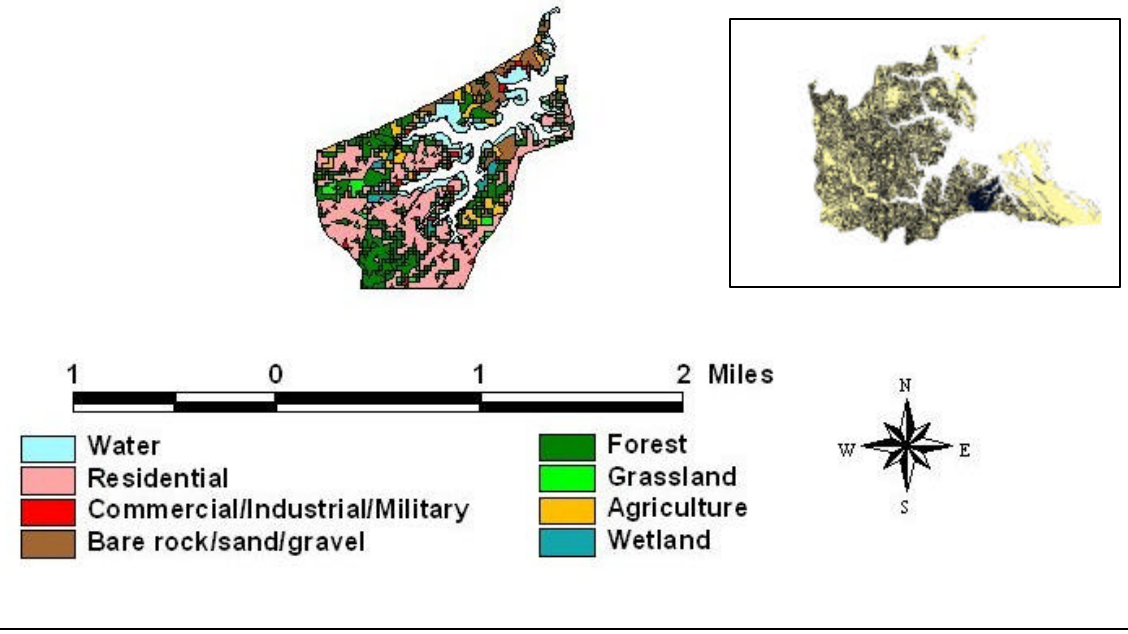


Roberts Creek Impervious Area Calculation by Land Use Type

Impervious area (weight factor)	Acres	Weight x Acres
2% impervious	**155.6**	**3.1**
9% Impervious	**4.4**	**0.4**
20% Impervious	**6.6**	**1.3**
70% Impervious	**20.5**	**14.4**
Watershed Totals	**187.1**	**19.2**

Impervious Area = **(%IMPERVIOUS)*(Acres of Impervious Type)**
Total watershed acres (less water and wetlands) = 10%

Figure 5.6
Whitehouse Cove Watershed Landuse



Whitehouse Cove Impervious Area Calculation by Land Use Type

Impervious area (weight factor)	Acres	Weight x Acres
2% impervious	**273.0**	**5.5**
9% Impervious	**38.9**	**3.5**
20% Impervious	**37.4**	**7.5**
70% Impervious	**31.6**	**22.1**
Watershed Totals	**380.9**	**38.5**

Impervious Area = **(%IMPERVIOUS)*(Acres of Impervious Type)**
Total watershed acres (less water and wetlands) = 10%

5.5. Margin of Safety

A Margin of Safety (MOS) is required as part of a TMDL in recognition of uncertainties in the understanding and simulation of water quality in natural systems. For example, knowledge is incomplete regarding the exact nature and magnitude of pollutant loads from various sources and the specific impacts of those pollutants on the chemical and biological quality of complex, natural water bodies. The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection.

The conservative assumptions (e.g. constant volume and no decay) made in the volumetric tidal modeling approach result in an equally conservative estimate in the TMDL calculation. Therefore, the MOS is implicitly included in the calculation.

5.6 TMDL Summary

To meet the water quality standards for both geometric mean and 90th percentile criteria, as well as the *enterococci* impairment, TMDLs for the Poquoson River are defined for the geometric mean load and the 90th percentile load, and the *enterococci* impairments. The TMDLs are summarized in the table 5.5, 5.6 and 5.7.

Table 5.5 TMDL Summary for Seven Shellfish Closures in the Poquoson River Watershed (geometric mean)

Condemnation Area	Pollutant Identified	Waste Load Allocation MPN/day	Load Allocation MPN/day	Total Allowable TMDL Load MPN/Day	Margin of Safety
137A Chisman Creek	Fecal Bacteria	1.06E+10	1.22E+11	1.33E+11	Implicit
137B Unamed Cove Patricks Creek	Fecal Bacteria	1.64E+07	3.12E+08	3.28E+08	Implicit
137C Patricks Creek	Fecal Bacteria	6.07E+08	1.15E+10	1.21E+10	Implicit
137D Poquoson River	Fecal Bacteria	4.22E+09	5.61E+10	6.03E+10	Implicit
137E Lambs Creek	Fecal Bacteria	1.00E+09	1.91E+10	2.01E+10	Implicit
137 F Roberts Creek	Fecal Bacteria	4.94E+08	4.45E+09	4.94E+09	Implicit
(DELISTED) Lyons Creek	Fecal Bacteria	1.17E+09	1.05E+10	1.17E+10	Implicit
137G Whitehouse Creek	Fecal Bacteria	2.44E+09	2.20E+10	2.44E+10	Implicit
(DELISTED) Bennett Creek	Fecal Bacteria	4.26E+08	3.83E+09	4.26E+09	Implicit
(DELISTED) Eastern Cove	Fecal Bacteria	5.66E+08	5.09E+09	5.66E+09	Implicit
151 Back Creek	Fecal Bacteria	6.45E+09	6.53E+10	7.17E+10	Implicit

Table 5.6 TMDL Summary for Shellfish Closures in the Back Creek Watershed (90th percentile)

Condemnation Area	Pollutant Identified	Waste Load Allocation MPN/day	Load Allocation MPN/day	Total TMDL Load Allocation MPN/day	Margin of Safety
137A Chisman Creek	Fecal Bacteria	3.71E+10	4.27E+11	4.64E+11	Implicit
137B Unamed Cove Patricks Creek	Fecal Bacteria	5.75E+07	1.09E+09	1.15E+09	Implicit
137C Patricks Creek	Fecal Bacteria	2.13E+09	4.04E+10	4.25E+10	Implicit
137D Poquoson River	Fecal Bacteria	1.48E+10	1.96E+11	2.11E+11	Implicit
137E Lambs Creek	Fecal Bacteria	3.51E+09	6.68E+10	7.03E+10	Implicit
137 F Roberts Creek	Fecal Bacteria	1.73E+09	1.56E+10	1.73E+10	Implicit
(DELISTED) Lyons Creek	Fecal Bacteria	4.08E+09	3.67E+10	4.08E+10	Implicit
137G Whitehouse Creek	Fecal Bacteria	8.54E+09	7.68E+10	8.54E+10	Implicit
(DELISTED) Bennett Creek	Fecal Bacteria	1.49E+09	1.34E+10	1.49E+10	Implicit
(DELISTED) Eastern Cove	Fecal Bacteria	1.98E+09	1.78E+10	1.98E+10	Implicit
151 Back Creek	Fecal Bacteria	2.26E+10	2.28E+11	2.51E+11	Implicit

Table 5.7 TMDL Summary for the Recreation Use Impairment in the upper Poquoson River Watershed

Impaired Waterbody Segment	Volume (m^3)	Bacteria Pollutant	Load Allocation (cfu/day)	Wasteload Allocation (cfu/day)	Total Load Allocation	Margin of Safety
VAT-C007E-004 Poquoson River, Upper	430830	*Enterococci*	3.14E+10	4.17E+11	4.48E+11	Implicit

6.0 TMDL Implementation

Once a TMDL has been approved by EPA, measures must be taken to reduce pollution levels from both point and non point sources in the stream (see section 7.4.2). For point sources, all new or revised VPDES/NPDES permits must be consistent with the TMDL WLA pursuant to 40 CFR '122.44 (d)(1)(vii)(B) and must be submitted to EPA for approval. The measures for non point source reductions, which can include the use of better treatment technology and the installation of best management practices (BMPs), are implemented in an iterative process that is described along with specific BMPs in the implementation plan. The process for developing an implementation plan has

been described in the "TMDL Implementation Plan Guidance Manual", published in July 2003 and available upon request from the DEQ and DCR TMDL project staff or at http://www.deq.virginia.gov/tmdl/implans/ipguide.pdf With successful completion of implementation plans, local stakeholders will have a blueprint to restore impaired waters and enhance the value of their land and water resources. Additionally, development of an approved implementation plan may enhance opportunities for obtaining financial and technical assistance during implementation.

6.1 Staged Implementation

In general, Virginia intends for the required bacteria reductions to be implemented in an iterative process that first addresses those sources with the largest impact on water quality. For example, in agricultural areas of the watershed, the most promising management practice is livestock exclusion from streams. This has been shown to be very effective in lowering bacteria concentrations in streams, both by reducing the cattle deposits themselves and by providing additional riparian buffers.

Additionally, in both urban and rural areas, reducing the human bacteria loading from failing septic systems should be a primary implementation focus because of its health implications. This component could be implemented through education on septic tank pump-outs as well as a septic system repair/replacement program and the use of alternative waste treatment systems.

In urban areas, reducing the human bacteria loading from leaking sewer lines could be accomplished through a sanitary sewer inspection and management program. Other BMPs that might be appropriate for controlling urban wash-off from parking lots and roads and that could be readily implemented may include more restrictive ordinances to reduce fecal loads from pets, improved garbage collection and control, and improved street cleaning.

The iterative implementation of BMPs in the watershed has several benefits:

1. It enables tracking of water quality improvements following BMP implementation through follow-up stream monitoring;
2. It provides a measure of quality control, given the uncertainties inherent in computer simulation modeling;
3. It provides a mechanism for developing public support through periodic updates on BMP implementation and water quality improvements;
4. It helps ensure that the most cost effective practices are implemented first; and
5. It allows for the evaluation of the adequacy of the TMDL in achieving water quality standards.

Watershed stakeholders will have opportunity to participate in the development of the TMDL implementation plan. While specific goals for BMP implementation will be established as part of the implementation plan development, the following stage 1 scenarios are targeted at controllable, anthropogenic bacteria sources and can serve as starting points for targeting BMP implementation activities.

6.2 Stage 1 Scenarios

The goal of the stage 1 scenarios is to reduce the bacteria loadings from controllable sources (excluding wildlife) such that violations of the single sample maximum recreation use criterion and the fecal coliform shellfish geometric mean and 90th percentile geometric mean are not exceeded. The stage 1 scenarios were generated with the same model setup as was used for the TMDL allocation scenarios.

{Present one or more scenarios with 0% wildlife reduction for bacteria TMDLs}

6.3 Link to Ongoing Restoration Efforts

{The following is a placeholder - modify to reflect local activities}

Implementation of this TMDL will contribute to on-going water quality improvement efforts aimed at restoring water quality in the Chesapeake Bay. Several BMPs known to be effective in controlling bacteria have also been identified for implementation as part of the Tributary Strategy for the Chesapeake Bay, small coastal basins. For example, management of on-site waste management systems, management of livestock and manure, and pet waste management are among the components of the strategy described under nonpoint source implementation mechanisms. Up-to-date information on the tributary strategy implementation process can be found at the tributary strategy web site under http://www.snr.state.va.us/Initiatives/TributaryStrategies/ChesapeakeBay.cfm.

6.4 Reasonable Assurance for Implementation

6.4.1 Follow-Up Monitoring

Following the development of the TMDL, the Department of Environmental Quality (DEQ) will make every effort to continue to monitor the impaired stream in accordance with its ambient monitoring program. DEQ's Ambient Watershed Monitoring Plan for conventional pollutants calls for watershed monitoring to take place on a rotating basis, bi-monthly for two consecutive years of a six-year cycle. In accordance with DEQ Guidance Memo No. 03-2004, during periods of reduced resources, monitoring can temporarily discontinue until the TMDL staff determines that implementation measures to address the source(s) of impairments are being installed. Monitoring can resume at the start of the following fiscal year, next scheduled monitoring station rotation, or where deemed necessary by the regional office or TMDL staff, as a new special study.

The purpose, location, parameters, frequency, and duration of the monitoring will be determined by the DEQ staff, in cooperation with DCR staff, the Implementation Plan Steering Committee and local stakeholders. Whenever possible, the location of the follow-up monitoring station(s) will be the same

as the listing station. At a minimum, the monitoring station must be representative of the original impaired segment. The details of the follow-up monitoring will be outlined in the Annual Water Monitoring Plan prepared by each DEQ Regional Office. Other agency personnel, watershed stakeholders, etc. may provide input on the Annual Water Monitoring Plan. These recommendations must be made to the DEQ regional TMDL coordinator by September 30 of each year.
DEQ staff, in cooperation with DCR staff, the Implementation Plan Steering Committee and local stakeholders, will continue to use data from the ambient monitoring stations to evaluate reductions in pollutants ("water quality milestones" as established in the IP), the effectiveness of the TMDL in attaining and maintaining water quality standards, and the success of implementation efforts. Recommendations may then be made, when necessary, to target implementation efforts in specific areas and continue or discontinue monitoring at follow-up stations.

In some cases, watersheds will require monitoring above and beyond what is included in DEQ's standard monitoring plan. Ancillary monitoring by citizens', watershed groups, local government, or universities is an option that may be used in such cases. An effort should be made to ensure that ancillary monitoring follows established QA/QC guidelines in order to maximize compatibility with DEQ monitoring data. In instances where citizens' monitoring data is not available and additional monitoring is needed to assess the effectiveness of targeting efforts, TMDL staff may request of the monitoring managers in each regional office an increase in the number of stations or monitor existing stations at a higher frequency in the watershed. The additional monitoring beyond the original bimonthly single station monitoring will be contingent on staff resources and available laboratory budget. More information on citizen monitoring in Virginia and QA/QC guidelines is available at http://www.deq.virginia.gov/cmonitor/.

To demonstrate that the watershed is meeting water quality standards in watersheds where corrective actions have taken place (whether or not a TMDL or TMDL Implementation Plan has been completed), DEQ must meet the minimum data requirements from the original listing station or a station representative of the originally listed segment. The minimum data requirement for conventional pollutants (bacteria, dissolved oxygen, etc) is bimonthly monitoring for two consecutive years. For biological monitoring, the minimum requirement is two consecutive samples (one in the spring and one in the fall) in a one year period.

6.4.2 Regulatory Framework

While section 303(d) of the Clean Water Act and current EPA regulations do not require the development of TMDL implementation plans as part of the TMDL process, they do require reasonable assurance that the load and wasteload allocations can and will be implemented. EPA also requires that all new or revised National Pollutant Discharge Elimination System (NPDES) permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). All such permits should be submitted to EPA for review.

Additionally, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (the "Act") directs the State Water Control Board to "develop and implement a plan to achieve fully supporting status for impaired waters" (Section 62.1-44.19.7). The Act also establishes that the implementation plan shall include the date of expected achievement of water quality objectives, measurable goals, corrective actions necessary and the associated costs, benefits and environmental impacts of addressing

the impairments. EPA outlines the minimum elements of an approvable implementation plan in its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process." The listed elements include implementation actions/management measures, timelines, legal or regulatory controls, time required to attain water quality standards, monitoring plans and milestones for attaining water quality standards. For the implementation of the WLA component of the TMDL, the Commonwealth intends to utilize the Virginia NPDES (VPDES) program, which typically includes consideration of the WQMIRA requirements during the permitting process. Requirements of the permit process should not be duplicated in the TMDL process, and with the exception of stormwater related permits, permitted sources are not usually addressed during the development of a TMDL implementation plan.

For the implementation of the TMDL's LA component, a TMDL implementation plan addressing at a minimum the WQMIRA requirements will be developed. An exception are the municipal separate storm sewer systems (MS4s) which are both covered by NPDES permits and expected to be included in TMDL implementation plans, as described in the stormwater permit section below.

Watershed stakeholders will have opportunities to provide input and to participate in the development of the TMDL implementation plan. Regional and local offices of DEQ, DCR, and other cooperating agencies are technical resources to assist in this endeavor.

In response to a Memorandum of Understanding (MOU) between EPA and DEQ, DEQ also submitted a draft Continuous Planning Process to EPA in which DEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL implementation plans developed within a river basin.

DEQ staff will present both EPA-approved TMDLs and TMDL implementation plans to the State Water Control Board for inclusion in the appropriate Water Quality Management Plan (WQMP), in accordance with the Clean Water Act's Section 303(e) and Virginia's Public Participation Guidelines for Water Quality Management Planning.

DEQ staff will also request that the SWCB adopt TMDL WLAs as part of the Water Quality Management Planning Regulation (9VAC 25-720), except in those cases when permit limitations are equivalent to numeric criteria contained in the Virginia Water Quality Standards, such as is the case for bacteria. This regulatory action is in accordance with §2.2-4006A.4.c and §2.2-4006B of the Code of Virginia. SWCB actions relating to water quality management planning are described in the public participation guidelines referenced above and can be found on DEQ's web site under http://www.deq.state.va.us/tmdl/pdf/ppp.pdf

6.4.3 Stormwater Permits

DEQ and DCR coordinate separate State programs that regulate the management of pollutants carried by storm water runoff. DEQ regulates storm water discharges associated with "industrial activities", while DCR regulates storm water discharges from construction sites, and from municipal separate storm sewer systems (MS4s).

EPA approved DCR's VPDES storm water program on December 30, 2004. DCR's regulations became effective on January 29, 2005. DEQ is no longer the regulatory agency responsible for administration and enforcement of the VPDES MS4 and construction storm water permitting programs. More information is available on DCR's web site through the following link: http://www.dcr.virginia.gov/sw/vsmp

It is the intention of the Commonwealth that the TMDL will be implemented using existing regulations and programs. One of these regulations is DCR's Virginia Stormwater Management Program (VSMP) Permit Regulation (4 VAC 50-60-10 et. seq). Section 4VAC 50-60-380 describes the requirements for stormwater discharges. Also, federal regulations state in 40 CFR §122.44(k) that NPDES permit conditions may consist of "Best management practices to control or abate the discharge of pollutants when:…(2) Numeric effluent limitations are infeasible,…".

Many parts of the Poquoson River watershed are covered by one of three VPDES permits for Virginia Stormwater Management Program (VSMP) permits. These are Phase II stormwater permits VAR040028 for York County and VAR040024 for the City of Poquoson, as well as a Phase I storm water general permit VA0088633 for the City of Hampton. All are for small municipal separate storm sewer systems (MS4s). The effective date of coverage is December 9 2002 through December 9, 2007 for the two Phase II permits and March 8, 2001 through March 8, 2006 for the Phase I general permit which will be re-issued.. The Phase II permits state, under Part II.A., that the "permittee must develop, implement, and enforce a stormwater management program designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable (MEP), to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act and the State Water Control Law."

The permit also contains a TMDL clause that states: "If a TMDL is approved for any waterbody into which the small MS4 discharges, the Board will review the TMDL to determine whether the TMDL includes requirements for control of stormwater discharges. If discharges from the MS4 are not meeting the TMDL allocations, the Board will notify the permittee of that finding and may require that the Stormwater Management Program required in Part II be modified to implement the TMDL within a timeframe consistent with the TMDL." ("Board" means the Soil and Water Conservation Board)

For MS4/VSMP general permits, the Commonwealth expects the permittee to specifically address the TMDL wasteload allocations for stormwater through the implementation of programmatic BMPs. BMP effectiveness would be determined through ambient in-stream monitoring. This is in accordance with recent EPA guidance (EPA Memorandum on TMDLs and Stormwater Permits, dated November 22, 2002). If future monitoring indicates no improvement in stream water quality, the permit could require the MS4 to expand or better tailor its stormwater management program to achieve the TMDL wasteload allocation. However, only failing to implement the programmatic BMPs identified in the modified stormwater management program would be considered a violation of the permit. DEQ acknowledges that it may not be possible to meet the existing water quality standard because of the wildlife issue associated with a number of bacteria TMDLs (see section 7.4.5 below). At some future time, it may therefore become necessary to investigate the stream's use designation and adjust the water quality criteria through a Use Attainability Analysis. Any changes to the TMDL resulting from water quality standards change in any tributary of the Poquoson River watershed would be reflected in the permit.

Wasteload allocations for stormwater discharges from storm sewer systems covered by a MS4 permit will be addressed in TMDL implementation plans. An implementation plan will identify types of corrective actions and strategies to obtain the wasteload allocation for the pollutant causing the water quality impairment. Permittees need to participate in the development of TMDL implementation plans since recommendations from the process may result in modifications to the stormwater management plan in order to meet the TMDL.

Additional information on Virginia's Stormwater Management program and a downloadable menu of Best Management Practices and Measurable Goals Guidance can be found at http://www.dcr.virginia.gov/sw/stormwat.htm.

6.4.4 Implementation Funding Sources

Cooperating agencies, organizations and stakeholders must identify potential funding sources available for implementation during the development of the implementation plan in accordance with the "Virginia Guidance Manual for Total Maximum Daily Load Implementation Plans". Potential sources for implementation may include the U.S. Department of Agriculture's Conservation Reserve Enhancement and Environmental Quality Incentive Programs, EPA Section 319 funds, the Virginia State Revolving Loan Program, Virginia Agricultural Best Management Practices Cost-Share Programs, the Virginia Water Quality Improvement Fund, tax credits and landowner contributions. The TMDL Implementation Plan Guidance Manual contains additional information on funding sources, as well as government agencies that might support implementation efforts and suggestions for integrating TMDL implementation with other watershed planning efforts.

6.4.5 Attainability of Primary Contact Recreation Use

In some streams for which TMDLs have been developed, water quality modeling indicates that even after removal of all bacteria sources (other than wildlife), the stream will not attain standards under all flow regimes at all times. These streams may not be able to attain standards without some reduction in wildlife load.

With respect to these potential reductions in bacteria loads attributed to wildlife, Virginia and EPA are not proposing the elimination of wildlife to allow for the attainment of water quality standards. However, if bacteria levels remain high and localized overabundant populations of wildlife are identified as the source, then measures to reduce such populations may be an option if undertaken in consultation with the Department of Game and Inland Fisheries (DGIF) or the United States Fish and Wildlife Service (USFWS). Additional information on DGIF's wildlife programs can be found at http://www.dgif.virginia.gov/hunting/va_game_wildlife/. While managing such overpopulations of wildlife remains as an option to local stakeholders, the reduction of wildlife or changing a natural background condition is not the intended goal of a TMDL.

To address the overall issue of attainability of the primary contact criteria, Virginia proposed during its latest triennial water quality standards review a new "secondary contact" category for protecting the recreational use in state waters. On March 25, 2003, the Virginia State Water Control Board adopted criteria for "secondary contact recreation" which means "a water-based form of recreation, the practice of which has a low probability for total body immersion or ingestion of waters (examples include but are not limited to wading, boating and fishing)". These new criteria became effective on February 12, 2004 and can be found at http://www.deq.virginia.gov/wqs/rule.html.

In order for the new criteria to apply to a specific stream segment, the primary contact recreational use must be removed. To remove a designated use, the state must demonstrate 1) that the use is not an existing use, 2) that downstream uses are protected, and 3) that the source of contamination is natural and uncontrollable by effluent limitations and by implementing cost-effective and reasonable best management practices for nonpoint source control (9 VAC 25-260-10). This and other information is collected through a special study called a Use Attainability Analysis (UAA). All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process. Additional information can be obtained at http://www.deq.virginia.gov/wqs/WQS03AUG.pdf.

The process to address potentially unattainable reductions based on the above is as follows: First is the development of a stage 1 scenario such as those presented previously in this chapter. The pollutant reductions in the stage 1 scenario are targeted primarily at the controllable, anthropogenic bacteria sources identified in the TMDL, setting aside control strategies for wildlife except for cases of nuisance populations. During the implementation of the stage 1 scenario, all controllable sources would be reduced to the maximum extent practicable using an iterative approach. DEQ will re-assess water quality in the stream during and subsequent to the implementation of the stage 1 scenario to determine if the water quality standard is attained. This effort will also evaluate if the modeling assumptions were correct. If water quality Standards are not being met, and no additional cost-effective and reasonable best management practices can be identified, a UAA may be initiated with the goal of re-designating the stream for secondary contact recreation.

7.0. Public Participation

During development of the TMDL for the Poquoson River watershed, public involvement was encouraged through a public participation process that included public meetings and stakeholder meetings.

The first public meeting was held on August 20th of 2005. A basic description of the TMDL process and the agencies involved was presented and a discussion was held to regarding the source assessment input, bacterial source tracking, and model results. This meeting was followed by development of the final draft TMDL and a review by the stakeholders. These comments and the draft report were discussed at a meeting comprised of representatives from the three local governments, the Hampton Roads Planning District Commission and responsible state agencies on November 16, 2005. Input from these meetings was utilized in the development of the TMDL.

The second public meeting where the TMDL load allocations were presented was held on March 16, 2006. Public involvement in the TMDL implementation planning process was encouraged.

8.0 Glossary

303(d). A section of the Clean Water Act of 1972 requiring states to identify and list water bodies that do not meet the states' water quality standards.

Allocations. That portion of receiving water's loading capacity attributed to one of its existing or future pollution sources (nonpoint or point) or to natural background sources. (A wasteload allocation [WLA] is that portion of the loading capacity allocated to an existing or future point source, and a load allocation [LA] is that portion allocated to an existing or future nonpoint source or to natural background levels. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading.)

Ambient water quality. Natural concentration of water quality constituents prior to mixing of either point or nonpoint source load of contaminants. Reference ambient concentration is used to indicate the concentration of a chemical that will not cause adverse impact on human health.

Anthropogenic. Pertains to the [environmental] influence of human activities.

Bacteria. Single-celled microorganisms. Bacteria of the coliform group are considered the primary indicators of fecal contamination and are often used to assess water quality.

Bacterial source tracking (BST). A collection of scientific methods used to track sources of fecal contamination.

Best management practices (BMPs). Methods, measures, or practices determined to be reasonable and cost-effective means for a landowner to meet certain, generally nonpoint source, pollution control needs. BMPs include structural and nonstructural controls and operation and maintenance procedures.

Clean Water Act (CWA). The Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972), Public Law 92-500, as amended by Public Law 96-483 and Public Law 97-117, 33 U.S.C. 1251 et seq. The Clean Water Act (CWA) contains a number of provisions to restore and maintain the quality of the nation's water resources. One of these provisions is section 303(d), which establishes the TMDL program.

Concentration. Amount of a substance or material in a given unit volume of solution; usually measured in milligrams per liter (mg/L) or parts per million (ppm).

Contamination. The act of polluting or making impure; any indication of chemical, sediment, or biological impurities.

Cost-share program. A program that allocates project funds to pay a percentage of the cost of constructing or implementing a best management practice. The remainder of the costs is paid by the producer(s).

Critical condition. The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence.

Designated uses. Those uses specified in water quality standards for each waterbody or segment whether or not they are being attained.

Domestic wastewater. Also called sanitary wastewater, consists of wastewater discharged from residences and from commercial, institutional, and similar facilities.

Drainage basin. A part of a land area enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into a receiving water. Also referred to as a watershed, river basin, or hydrologic unit.

Existing use. Use actually attained in the waterbody on or after November 28, 1975, whether or not it is included in the water quality standards (40 CFR 131.3).
Fecal Coliform. Indicator organisms (organisms indicating presence of pathogens) associated with the digestive tract.
Geometric mean. A measure of the central tendency of a data set that minimizes the effects of extreme values.
GIS. Geographic Information System. A system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. (Dueker and Kjerne, 1989)
Infiltration capacity. The capacity of a soil to allow water to infiltrate into or through it during a storm.
Interflow. Runoff that travels just below the surface of the soil.
Loading, Load, Loading rate. The total amount of material (pollutants) entering the system from one or multiple sources; measured as a rate in weight per unit time.
Load allocation (LA). The portion of a receiving waters loading capacity attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished (40 CFR 130.2(g)).
Loading capacity (LC). The greatest amount of loading a water body can receive without violating water quality standards.
Margin of safety (MOS). A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body (CWA section 303(d)(1)©). The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by EPA either individually or in state/EPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS).
Mean. The sum of the values in a data set divided by the number of values in the data set.
Monitoring. Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.
Narrative criteria. Non-quantitative guidelines that describe the desired water quality goals.
Nonpoint source. Pollution that originates from multiple sources over a relatively large area. Nonpoint sources can be divided into source activities related to either land or water use including failing septic tanks, improper animal-keeping practices, forest practices, and urban and rural runoff.
Numeric targets. A measurable value determined for the pollutant of concern, which, if achieved, is expected to result in the attainment of water quality standards in the listed waterbody.
Point source. Pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial waste treatment facilities. Point sources can also include pollutant loads contributed by tributaries to the main receiving water waterbody or river.
Pollutant. Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water. (CWA section 502(6)).

Pollution. Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Privately owned treatment works. Any device or system that is (a) used to treat wastes from any facility whose operator is not the operator of the treatment works and (b) not a publicly owned treatment works.

Public comment period. The time allowed for the public to express its views and concerns regarding action by EPA or states (e.g., a Federal Register notice of a proposed rule-making, a public notice of a draft permit, or a Notice of Intent to Deny).

Publicly owned treatment works (POTW). Any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Raw sewage. Untreated municipal sewage.

Receiving waters. Creeks, streams, rivers, lakes, estuaries, ground-water formations, or other bodies of water into which surface water and/or treated or untreated waste are discharged, either naturally or in man-made systems.

Riparian areas. Areas bordering streams, lakes, rivers, and other watercourses. These areas have high water tables and support plants that require saturated soils during all or part of the year. Riparian areas include both wetland and upland zones.

Riparian zone. The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The duration of flooding is generally much shorter, and the timing less predictable, in a riparian zone than in a river floodplain.

Runoff. That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

Septic system. An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a drain field or subsurface absorption system consisting of a series of percolation lines for the disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

Sewer. A channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers handle both.

Slope. The degree of inclination to the horizontal. Usually expressed as a ratio, such as 1:25 or 1 on 25, indicating one unit vertical rise in 25 units of horizontal distance, or in a decimal fraction (0.04), degrees (2 degrees 18 minutes), or percent (4 percent).

Stakeholder. Any person with a vested interest in the TMDL development.

Surface area. The area of the surface of a waterbody; best measured by planimetry or the use of a geographic information system.

Surface runoff. Precipitation, snowmelt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants.

Surface water. All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors directly influenced by surface water.

Topography. The physical features of a geographic surface area including relative elevations and the positions of natural and man-made features.
Total Maximum Daily Load (TMDL). The sum of the individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources and natural background, plus a margin of safety (MOS). TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.
VADEQ. Virginia Department of Environmental Quality.
VDH. Virginia Department of Health.
Virginia Pollutant Discharge Elimination System (NPDES). The national program for issuing, modifying, revoking and re-issuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Clean Water Act.
Wasteload allocation (WLA). The portion of a receiving waters' loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation (40 CFR 130.2(h)).
Wastewater. Usually refers to effluent from a sewage treatment plant. See also **Domestic wastewater**.
Wastewater treatment. Chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water to remove, reduce, or neutralize contaminants.
Water quality. The biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody's ability to support beneficial uses.
Water quality criteria. Levels of water quality expected to render a body of water suitable for its designated use, composed of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or states for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.
Water quality standard. Law or regulation that consists of the beneficial designated use or uses of a waterbody, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement.
Watershed. A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.
WQIA. Water Quality Improvement Act.

9.0 Citations

Thomann, R. V. and J. Mueller (1987). Principles of surface water quality modeling and control. Harper Collins Publishers.

US EPA Shellfish Workshop Document (2002).

VA DEQ 1998 303(d) List of Impaired Waters.

Bacteria Source Tracking Analysis to Support Virginia's TMDLs. December 2004. MapTech Inc. Blacksburg, Virginia.

10.0 Appendices

Appendix A Growing Area 53: Shoreline Sanitary Survey and Condemnation Notices

Appendix B Supporting Documentation and Watershed Assessment

Appendix C Water Quality Data

Appendix D 1) Code of Virginia §62.1-194.1 Obstructing or contaminating state waters.
2) 33 CFR Volume 2, Parts 120 to 199. Revised as of July 1, 2000

Appendix A: Growing Area 53: 1) Shoreline Sanitary Survey

POQUOSON RIVER AND BACK CREEK

York County and City of Poquoson

Shoreline Sanitary Survey

Date: May 22, 2002

Survey Period: August 23, 2001 – April 3, 2002

Total Number of Properties Surveyed: 622

Surveyed By: T. D. Fearington, H. J. Isiminger, H. R. Barker, Jr., and J. E. Merritt

SECTION A: GENERAL

This survey extends from Reference Point 53 at the northwest mouth of Thorofare, (triangulation marker "Sandbox") to Reference Point 54 at Thorofare Creek, northwest mouth, including the Chesapeake Bay shoreline between these two points: Thorofare, Back Creek, Claxton Creek, Bay Tree Creek, Chisman Creek, (Cabin Creek, Goose Creek, and Boathouse Creek), Hodges Creek, Poquoson River (Patrick Creek, Quarter March Creek, Moores Creek, and Lambs Creek), Roberts Creek, Bennett Creek (Lyons Creek, White House Cove, Floyds Bay, and Eastern Cove), Lloyd Bay, Sandy Bay, Rock Creek, Big Salt Marsh, Fire Pine Creek, Gum Hammock Creek, and all their tributaries.

The topography of the area is characterized by large marshes in the eastern section, with elevations of less than 5' including the Goodwin Islands group, Crab Neck, Cow Island, and Big Salt Marsh. Elevations rise to between 5' and 15' forming a plateau, which extends several miles westward near U.S. Route 17 before rising to approximately 50' near the eastern edge of Harwoods Mill Reservoir and U.S. Route 17.

Population density within the survey area varies from moderate to heavy in the City of Poquoson; the communities of Seaford, Grafton, Dare, and Tabb; and the developments of Goodwin Neck Estates, York Point, Evergreen Shores, Seaford Shores, Cheadle Heights, and Piney Point Estates in York County. All of these developments consist of single family dwellings served by on-site sewage disposal systems. Similarly, some sections within the City of Poquoson are served by on-site sewage disposal.

However, the majority of homes and businesses in Poquoson are served by Hampton Roads Sanitation Districts (HRSD) sewerage system and connected to the York River sewage treatment plant. HRSD service is expanding in both the City of Poquoson and in York County with connection to the system mandatory after the connection becomes available although under varying time frames. Therefore the on-site sewage disposal systems are disappearing and are now found in dispersed pockets around the city and the county.

The economy of the area is dependent primarily upon light industry, local commerce and services, a declining seafood industry, and military installations in the surrounding parts of the Lower Peninsula and Hampton Roads.

Meteorological data indicated that the area received a total rainfall of 16.45" for the survey period. A monthly breakdown is as follows:

August 23-31, 2001	0.35"	December	1.40"	April 1-3	0.24"		
September	2.15"	January, 2002	4.33"				
October	0.03"	February	1.35"				
November	0.19"	March	6.41"				

Three certified shellfish plants are located within the survey boundary: E. T. Firth Wholesale Seafood, VA204SP, Wells Ice and Cold Storage, VA 907RP, and Preston Petre, VA928SS, (boat operation). William F. Hunt, VA589SS, has gone out of business since the last survey of the area. Recreational boaters and commercial fisherman both use the Poquoson River watershed. Large numbers of waterfowl are found in the river and marsh areas, and in winter many ducks and geese use the waters of this area as a stopover or winter destination.

The current restrictions on shellfish harvesting are Condemned Shellfish Area #137, Poquoson River, revised 11 April 2002; and Condemned Shellfish Area #151, Back Creek, York County, revised 30 April 2001. Copies of the current condemnation notices and maps are attached to the back of this report.

Information in this report is gathered by and primarily for use of the Division of Shellfish Sanitation, Virginia Department of Health, in order to fulfill its responsibilities of shellfish growing area supervision and classification. However, the data are made available to various agencies participating in shellfish program coordinated activities or other interested parties. The Engineering Appendix is available by request from the Richmond Office of the Division of Shellfish Sanitation.

Report copies are provided to the local health department for corrective action of deficiencies listed on the summary page in Sections B.2. and B.3. and the Department of Environmental Quality for possible action at properties listed on the summary page in Sections B.1., C.1., and C.2. The division of Soil and Water Conservation is provided information on possible sources of animal pollution found in Section E.

This report lists only those properties which have a sanitary deficiency or have other environmental significance. Individual field forms with full information on the properties listed in this report are on file in the Richmond Office of the Division of Shellfish Sanitation and are available for reference until superseded by subsequent resurvey of the area.

SECTION B: SEWAGE POLLUTION SOURCES

SEWAGE TREATMENT FACILITIES

10. ***DIRECT*** - [redacted] VPDES Permit #VA0081311. Design flow 15 MGD. Treatment consists of 2 barscreens, 2 aerated grit chambers, 2 preaeration chambers, 3 primary clarifiers, 6 aeration tanks, 3 secondary clarifiers, 2 chlorine contact units, and 1 dechlorination chamber. Final effluent discharges to the York River in Area 52. See Engineering Study in Area 52 survey for more information.

ON-SITE SEWAGE DEFICIENCIES

9. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) - L[redacted]. Dwelling- brick 1 story with cream trim. No contact. Laundry waste drains from 2" black hose at rear wall of garage onto ground suffice. Hose connected from exterior water spigot to roof vent stack of sanitary system. Sanitary Notice issued 8-23-01 to field #M015.

16. CONTRIBUTES POLLUTION - Location: [redacted]. Dwelling- barn/shop/dwelling 2 story. No contact. Effluent erupting from drainfield onto ground surface. Sanitary Notice issued 10-11-01 to field #H11.

17. CONTRIBUTES POLLUTION - [redacted]. Dwelling- brick ranch 1 story with dark shutters and white trim and detached carport at right. 5 persons. Effluent erupting from septic tank onto ground surface in front yard. Sanitary Notice issued 1-31-02 to field #H37.

18. CONTRIBUTES POLLUTION - Location: [redacted]. Dwelling- white clapboard 1 story with screened front porch. No contact. Effluent erupting from septic tank lid onto ground surface. Sanitary Notice issued 3-8-02 to field #H131

19. CONTRIBUTES POLLUTION - [redacted]. Dwelling- light green aluminum siding 1 story with fenced back yard. No contact. Effluent erupting from septic tank onto ground surface. Sanitary Notice issued 3-8-02 to field #H135.

21. CONTRIBUTES POLLUTION, ***DIRECT*** - Location: 3[redacted] Dwelling- old yellow house trailer with added screen porch. No contact. Effluent erupting from septic tank onto ground surface behind trailer, flowing down swale toward boat ramp and into Chisman Creek. Sanitary Notice issued 3-15-02 to field #H160.

23. CONTRIBUTES POLLUTION, ***DIRECT*** - Location: [redacted] Dwelling- blue and white house trailer. No contact. Effluent erupting from septic tank onto ground surface at end of trailer, 75' from Chisman Creek. Sanitary Notice issued 3-15-02 to field #H168.

24. CONTRIBUTES POLLUTION - [redacted] Dwelling- brick 2 story with 1½ story vinyl siding attachment with cream trim. 3 persons. Effluent erupting from septic tank onto ground surface. Sanitary Notice issued 3-1-02 to field #Q027.

29. CONTRIBUTES POLLUTION - [redacted]. Dwelling- brick 1 story "A" roof with light green trim. No contact. Lid missing from septic tank; covered with particle board. Sanitary Notice issued 11-9-01 to field #F42.

55. CONTRIBUTES POLLUTION - [redacted]. Dwelling- white vinyl siding 1½ story with brown shutters and teal trim. 2 persons. Effluent erupting from septic tank onto ground surface directly above tank lid. Sanitary Notice issued 2-25-02 to field #Q008.

POTENTIAL POLLUTION

3. [redacted]. Dwelling- taupe stucco 1 story with red shutters and trim. No contact. Approximately 1½ acres with 2 garages, 7 junk trucks and cars, machine parts, campers, camper shells, and other miscellaneous junk.

9. [redacted]. Dwelling- brick 1 story with white trim. No contact. Back yard filled with miscellaneous junk including water pumps for tanks, 7 broken lawn mowers, 2 junked boats, an old truck, and various pieces of machinery.

41. [redacted]. Dwelling- white aluminum siding 1 story with red shutters. 3 persons. Observed at time of survey was a ¾ acre parcel with 11 junked vehicles, 1 old boat, siding, metal, barrels and miscellaneous junk.

42. [redacted]. Dwelling- brick 1 story with white trim and metal green and white front awning. 2 persons. Owner stated that during wet weather the area behind shed becomes damp and has a septic odor.

43. [redacted]. Dwelling- brown frame 2 story. 2 persons. Owner stated that at very high tides and during very wet weather sewage backs up into the toilet and will not flush from bowl. The house elevation is 4' above the Poquoson River.

48. [redacted]. Dwelling- brick 1 story with white trim. 2 persons. Owner stated that house fixtures back up into the bathtub.

51. [redacted]. Dwelling- brick 1 story with white trim. No contact. Observed at time of survey was a ¾ acre lot with 5 old vehicles, several camper shells, sheet metal, wood and other miscellaneous junk.

52. [redacted]. Dwelling- white vinyl siding 2 story with gray shutters and trim and 2 out buildings. 3 persons. Observed on site were two large fuel tanks of unknown capacity awaiting removal, 1 X 1000 gallon diesel fuel tank and 1 X 500 gallon gasoline tank. Formerly this was a construction business.

63. Location: [redacted]. Dwelling- green asbestos 1 story with white trim. 1 person. Hand dug trench leading away from septic tank lid with no evidence of recent eruption.

SECTION C: NONSEWAGE WASTE SITES

INDUSTRIAL WASTES

7. [redacted] Business- oil refinery. No contact. All industrial wastes from this facility are permitted by DEQ permit #VA0003018 and discharge into shellfish growing area #52. However several extremely large oil storage tanks surrounded by concrete berms are located within this survey area.

13. ***DIRECT*** - [redacted]. Business- certified VA scallop repacker, (VA 907RP). 22 employees. Processing wastes from floor drains and wash down hoses discharge into Back Creek. Facility scheduled to be connected to HRSD by June 13, 2002. Has general permit #VAG523023 from DEQ/TRO.

14. ***DIRECT*** - [redacted]. Business- scallop and fish offloading facility. 50 employees, (with boat crews). Wastes from wash down hoses at scallop and fish offloading docks discharge into Back Creek. Facility scheduled to be connected to HRSD by June 13, 2002. Has general permit #VAG523024 from DEQ/TRO.

28. Occupant: [redacted]. Public- recreation area. No contact. Virginia Power EPA Superfund fly ash dumpsite adjacent to recreation area.

30. Occupant: [redacted] Public: recreation area. No contact. Virginia Power EPA Superfund fly ash dumpsite adjacent to recreation area.

34. ***DIRECT*** [redacted]. Business- marine repairs. 3 employees. Found on site were oils, paints, grease, welding wastes, fuel and other items used at marine railway adjacent to Chisman Creek.

40. [redacted]. Business- gray blue frame 1 story shop. No contact. Observed on site were open containers of brake fluid, oil and other unknown solvents. The odor of oil and petroleum products everywhere.

45. [redacted]. Dwelling- brick 1 story with white trim. 2 persons. Found on site were tractors, 450 gallons of diesel fuel in tanks, farm chemicals, and open containers of grease.

58. ***DIRECT*** - [redacted]. Business- certified shellfish dealer (VA 204SP) with small pier for workboats. 3 employees. Processing wastes from floor drains and wash down hose discharge into White House Cove. Has VPDES permit #VASEA2617 from DEQ/TRO.

SOLID WASTE DUMPSITES

8. [redacted]. Business: Repair and welding shop. No contact. ½ acre of old tires, 2 refrigerators, several old transformers, old welding machines, 3 large truck containers, and miscellaneous junk.

27. [redacted]. Business- salvage yard and used car business. 4 employees. Approximately 5 acres with several hundred junked autos and auto parts. Used oil stored on slab under roof.

31. [redacted]. Business- receiving site for construction debris; has office in trailer. No contact. Found at the site were lumber, roofing material, concrete, siding, glass, pipe, plastic, paving materials, soil and other construction debris.

39. [redacted]. Business- brick auto repair shop. 3 employees. Observed on site were 20 junk autos, 10 batteries, 300 gallon above groundused oil tank and two 50 gallon drums for used anti freeze on a slab. Storage tanks are without berms.

40. [redacted] Business- gray blue frame 1 story shop. No contact. Approximately 1 acre of miscellaneous car parts, 10 trucks and cars in differing degrees of disrepair, engines, glass and camper shells.

53. [redacted]. Dwelling- 4 faded white frame 1 story buildings used as automotive garages and for general storage. 2 persons. Found on site were 12 cars and trucks, 2 pieces of heavy equipment, 3 recreational type vehicles, trailers, 3 boats, scrap metal, tires, exposed oil drums and miscellaneous items.

54. [redacted] Dwelling- white brick and frame 2 story with black shutters. No contact. Found over 1 acre were several pieces of construction equipment, 6 old cars, 1 bus, construction debris, 2 X 55 gallon oil drums, tires and miscellaneous items.

56. [redacted]. Business- restaurant and marina. 3 employees. Approximately 1 acre of construction debris, 12 junked vehicles, telephone poles and miscellaneous items.

67. ***DIRECT*** - [redacted]2 (across from 162 and 168 Ridge Road and next to 171 Ridge Road). No contact. In the marsh on road past locked gate are numerous old tires and several rusting automobiles. Large concrete conduits are found at end of road.

68. ***DIRECT*** - Location: [redacted] Public- city dump for metal. No contact. Found at the site were over 100 refrigerators and other large appliances. It appears that these items are at some point covered with soil.

SECTION D: BOATING ACTIVITY

MARINAS

5. [redacted] Marine- white frame 2 story clubhouse and marina. 1 person. 60 slips available. Present on 10-30-01 were 3 pleasure boats under 26' and 37 pleasure boats over 26'. Boating services provided are electricity and water. Sanitary facilities provided are 3 commodes, 2 lavatories, and 2 showers for men; and 3 commodes, 2 lavatories, and 2 showers for women. Sewage disposal is to septic tank and drainfield which appeared to be working satisfactorily at time of survey. Boat holding tank pump-out facilities and portable toilet dump station facilities are provided at this location. Containers are present for solid waste disposal.

11. [redacted]. Marine- commercial marina. No contact. 59 seasonal slips/moorings and 3 transient slips available. Present on 10-18-01 were 13 pleasure boats under 26' and 1 workboat and 13 pleasure boats over 26'. Boating services provided are an in-out boat ramp, fuel, water, and electricity. Sanitary facilities provided are 1 urinal for men, 1 unisex commode and 1 unisex lavatory. Sewage disposal is by septic tank and drainfield, which appeared to be working satisfactorily at time of inspection. Boat holding tank pump-out facilities were not operational on 10-18-01. There are no portable toilet dump station facilities at this location. Containers are present for solid waste disposal.

14. [redacted]. Marine- scallop and fish offloading dock. 50 employees, (with boat crews). 17 slips/moorings available. Present on 8-3-00 were 5 work boats over 26'. Boating services provided are boat fuel, repairs, water and electricity. Sanitary facilities provided are 6 commodes, 2 urinals, 4 lavatories and 1 shower for men; and 1 commode and 1 lavatory for women. Sewage disposal is by septic tank and drainfield 50' from Back Creek at 6' elevation. Septic system appeared to be working satisfactorily at time of inspection. Boat holding tank pump-out facilities are available at this facility. There are no portable toilet dump station facilities provided at this location. Containers are provided for solid waste disposal.

20. [redacted]. Business- commercial marina. 3 employees. 26 slips/moorings available. Present on 10-17-01 were 1 work boat and 1 pleasure boat under 26'; and 3 work boats and 7 pleasure boats greater than 26'. Boating services provided are repairs, water, and electricity. Sanitary facilities provided are 1 commode and 1 lavatory for men; and 1 commode and 1 lavatory for women. Sewage disposal is by septic tank and drainfield, which appeared to be working satisfactorily at time of inspection. Boat holding tank pump-out facilities are available at this location. There are no portable toilet dump station facilities provided at this location. Containers are provided for solid waste disposal.

22. [redacted] Marine- complex of small residences, house trailers, and other buildings with commercial marina. 1 employee. 39 slips available. Present on 10-17-01 were 17 pleasure boats under 26' and 13 pleasure boats over 26'. Boating services provided are an in-out ramp, water and electricity. Sanitary facilities provided are 1 commode and 1 lavatory for men; and 1 commode and 1 lavatory for women. Sewage disposal is to septic tank and drainfield, which appeared to be working satisfactorily at time of inspection. There are no boat holding tank pump-out facilities and no portable toilet dump station facilities at this location. Containers are provided for solid waste disposal.

35. [redacted]. Marine- commercial marina and boat yard. No contact. 53 slips/moorings and 185 dry storage spaces available. Present on 10-29-01 were 13 pleasure boats under 26' and 23 pleasure boats over 26' in wet slips; and in dry storage there were 213 pleasure boats under 26'. Boating services provided are fuel, repairs, water and electricity. Sanitary facilities provided are 1 commode, 1 urinal, 2 lavatories and 1 shower for men; and 2 commodes, 2 lavatories and 1 shower for women. Sewage disposal is to HRSD sewage system. Boat holding tank pump-out facilities and portable toilet dump station facilities are provided at this location. Containers are present for solid waste collection.

57. [redacted]. Marine- marina with various outbuildings. 3 employees. 87 slips available. Present on 10-4-01 were 3 work boats and 14 pleasure boats under 26'; 27 work boats and 5 pleasure boats over 26' all in wet slips. In dry storage there were 1 work boat and 1 pleasure boat under 26'. Boating services provided are repairs, water and electricity. Sanitary facilities provided are 2 unisex commodes and 1 shower which is in violation of marina regulations. Sewage disposal is to septic tank and drainfield, which appeared to be working satisfactorily at time of inspection. Boat holding tank pump-out facilities and portable toilet dump station facilities are provided at this location. Containers are provided for solid waste disposal.

59. [redacted]. Marine- marina with small white frame 1 story building for office and rest rooms. 1 employee. 32 slips available. Present on 10-4-01 were 18 pleasure boats under 26', and 1 workboat and 6 pleasure boats over 26'. Boating services provided are electricity and water. Sanitary facilities provided are 1 commode, 1 lavatory and 1 shower for men; and 1 commode, 1 lavatory and 1 shower for women. Sewage disposal is to HRSD. Boat holding tank pump-out facilities and portable toilet dump station facilities are provided at this location. Containers are provided for solid waste disposal.

60. [redacted]. Marine- commercial marina. 5 employees. 156 slips and 34 dry storage spaces available. Present on 11-01-01 were 2 work boats and 60 pleasure boats under 26', and 87 pleasure boats over 26' in wet slips; and in dry storage there were 20 pleasure boats under 26' and 9 pleasure boats over 26'. Boating services provided are an in-out ramp, repairs, water and electricity. Sanitary facilities provided are 1 commode, 1 lavatory and 1 shower for men; and 1 commode, 1 lavatory and 1 shower for women. Sewage disposal is to HRSD. There are no boat holding tank pump-out facilities and no portable toilet dump station facilities at this location. Containers are provided for solid waste disposal.

66. [redacted]. Marine- crab offloading dock with corrugated sheet metal building. No contact. 11 slips/moorings available. Present on 10-30-01 were 3 work boats under 26' and 1 workboat over 26'. Boating services provided are water and electricity. Sanitary facilities provided are 1 privy for men and 1 privy for women. Has an exemption to the requirement to provide boat holding tank pump-out facilities. There are portable toilet dump station facilities provided at this location. Containers are provided for solid waste disposal.

OTHER PLACES WHERE BOATS ARE MOORED

1. [redacted]. Marine- private commercial dock. 12 persons. 10 slips and 4 dry storage spaces. Present on 10-17-01 were 2 pleasure boats and 2 work boats under 26', and 4 pleasure boats over 26' in wet slips. The only boating service provided is repairs. Sanitary facilities include 1 unisex commode and 1 unisex lavatory. Sewage disposal is to septic tank and drainfield which appeared to be in satisfactory condition at time of survey. There are no boat holding tank pump-out facilities and no portable toilet dump station facilities available at this location. Containers are present for solid waste disposal.

2. [redacted]. Marine- private pier and in-out ramp. No contact. 7 slips and 2 dry storage spaces available. There were no boats present on 8-23-01. Sanitary facilities consist of 1 privy, which was in satisfactory condition at time of survey. The only boating service provided is an in-out ramp. Has an exemption to the requirements to provide boat holding tank pump-out facilities. There are no portable toilet dump station facilities at this location. Containers are present for solid waste disposal.

4. [redacted]. Marine- private pier at residence. 2 persons. 8 slips. No boats were present on 10-29-01. There are no boating services provided at this location. There are no sanitary facilities, no boat holding tank pump-out facilities, and no portable toilet dump station facilities at this location. No containers are present for solid waste disposal.

12. [redacted] Business- welding repair services. No contact. 2 moorings. Present on 10-18-01 were 2 workboats greater than 26'. The only boating service provided is repairs. Sanitary facilities provided include 1 commode and 1 lavatory for men; and 1 commode and 1 lavatory for women. Sewage disposal is to septic tank and drainfield, which appeared to be in satisfactory condition at time of survey. This facility has an exemption to the requirements to provide boat holding tank pump-out facilities and portable toilet dump station facilities. Containers are present for solid waste disposal.

25. [redacted] No contact. 12 slips available. No boats were present on 10-18-01. Boating services provided are an in-out boat ramp, water and electricity. Sanitary facilities provided are 1 privy for men and 1 privy for women. Has an exemption to the requirement of providing boat holding tank pump-out facilities. Portable toilet dump station facilities are provided at this location. Containers are present for solid waste disposal.

26. [redacted]. Marine- private community pier and ramp. No contact. 12 slips/moorings available. Present on 10-17-01 were 3 pleasure boats under 26'. Boating services provided are an in-out boat ramp, water, and electricity. There are no sanitary facilities, no boat holding tank pump-out facilities and no portable toilet dump station facilities at this location. No containers are present for solid waste disposal.

34. [redacted]. Marine- marine railway and white frame 2½ story building. 2 persons. 5 slips/moorings and 3 dry storage spaces available. Present on 10-29-01 were 1 pleasure boat under 26' and 1 pleasure boat over 26'. Boating services provided include in-out ramp, electricity and water. Sanitary facilities provided are 1 commode, 1 urinal, 1 lavatory and 1 shower for men. Sewage disposal is to HRSD public sewage system. There are no boat holding tank pump-out facilities and no portable toilet dump station facilities provided at this location. Containers are present for solid waste disposal.

56. [redacted]. Marine- restaurant and private marina. 3 persons. 4 slips available. Present on 10-4-01 were 1 pleasure boat under 26' and 1 pleasure boat over 26'. Boating services provided are fuel, in-out ramp and electricity. Sanitary facilities provided are 1 commode, 1 urinal and 1 lavatory for men; and 1 commode and 1 lavatory for women. Sewage disposal is by septic tank and drainfield, which appeared to be in satisfactory condition at time of survey. Has an exemption to the requirement to provide boat holding tank pump-out facilities. There are no portable toilet dump station facilities provided at this location. Containers are provided for solid waste disposal.

58. [redacted]. Business-offloading pier for shellfish plant. 3 employees. 3 slips available. Present on 8-9-00 were 2 work boats over 26'. There are no boating services provided at this location. Sanitary facilities provided are 1 male privy and 1 female privy. Has an exemption to the requirement to provide boat holding tank pump-out facilities. There are no portable toilet dump station facilities provided at this location. Containers are provided for solid waste disposal.

61. [redacted] Marine- public ramp and pier. No contact. 4 slips available. There were no boats present on 8-23-01. The only boating service provided is an in-out ramp. There are no sanitary facilities and no portable toilet dump station facilities provided at this location. Boat holding tank pump-out facilities are provided at this location. Containers are provided for solid waste disposal.

62. [redacted]. Marine- private pier. No contact. 5 slips and 1 dry storage space available. Present on 10-4-01 were 1 pleasure boat under 26' and 2 pleasure boats over 26' in wet slips. Boating services provided are electricity and water. Has exemptions to the requirements to provide sanitary facilities, boat holding tank pump-out facilities and portable toilet dump station facilities. Containers are present for solid waste disposal.

65. [redacted]. Marine- 1 story white construction block building. Former shellstock shipper operation now vacant (Hunt's Seafood). No contact. 5 slips available. No boats were present on 10-4-01. Boating services provided are in-out boat ramp, water and electricity. The only sanitary facility provided is a privy. There are no boat holding tank pump-out facilities at this location. A portable toilet dump station is provided. Containers are present for solid waste disposal.

UNDER SURVEILLANCE

6. [redacted] Marine- public in-out boat ramp. No contact. 3 slips available. Present on 8-23-01 were 2 pleasure boats under 26'. The only boating service provided is an in-out ramp. Sanitary facilities provided are 2 commodes, 1 urinal, and 1 lavatory for men; and 2 commodes, and 1 lavatory for women. Sewage disposal is by septic tank and drainfield which appeared to be working satisfactorily at time of survey. There are no boat holding tank pump-out facilities and no portable toilet dump station facilities at this location. Containers are present for solid waste disposal.

33. [redacted]. Marine- private dwelling with 4 boat slips. No contact. 4 slips and 1 dry storage space available. There were no boats present on 8-23-01. There are no boating services, no sanitary facilities, no boat holding tank pump-out facilities and no portable toilet dump station facilities provided at this location. No containers are present for solid waste disposal.

37. [redacted]. Marine- community pier for residents of Chesapeake Watch at Ship Point subdivision. No contact. 7 slips available. No boats were present at time of survey. There are no boating services, no sanitary facilities, no boat holding tank pump-out facilities and no portable toilet dump station facilities provided at this location. No containers are present for solid waste disposal.

47. [redacted]. Public- public ramp and pier. No contact. 3 moorings. There were no boats present on 10-29-01. The only boating service provided is 3 in-out boat ramps. There are no sanitary facilities, no boat holding tank pump-out facilities and no portable toilet dump station facilities at this location. Containers are provided for solid waste disposal.

50. [redacted] Private community boat facility. 1 employee. 2 mooring available. There were no boats present on 10-29-01. There are no boating services, no sanitary facilities, no boat holding tank pump-out facilities and no portable toilet dump station facilities provided at this location. No containers are provided for solid waste disposal.

64. [redacted] Marine- private pier. 2 persons. 4 moorings available. Present on 10-4-01 were 4 work boats under 26'. There are no boating services provided at this location. There are no sanitary facilities, no boat holding tank pump-out facilities and no portable toilet dump station facilities provided at this location. Containers are present for solid waste disposal.

SECTION E: CONTRIBUTES ANIMAL POLLUTION

15. [redacted] Dwelling- modern "A" frame with deck. No contact. Present at time of survey were 3 pastured horses, 11 pastured sheep, 7 kenneled dogs and an unknown number of caged chickens 100 feet from a tributary of Back Creek without direct access to tidal waters. No method of manure disposal was observed.

32. ***DIRECT*** - [redacted]. Dwelling- brick rancher 1 story with black roof and beige trim. No contact. Present at time of survey were 6 caged chickens and 1 blind pony wandering the property with direct access to Chisman Creek. Manure disposal is unknown.

34. ***DIRECT*** - [redacted]. Dwelling- white frame 2 story with green tin roof. 3 persons. Present at time of survey were 11 cattle with direct access to Chisman Creek. Manure is stored 60' from creek and is spread on the garden.

36. [redacted]. Dwelling- white aluminum siding 1½ story. No contact. Present at time of survey were 18-20 pastured cattle 50 feet from tributary to Chisman Creek without direct access to tidal waters. Manure appears to be spread on pasture.

38. [redacted]. Dwelling- white vinyl siding 2 story with green trim. No contact. Present at time of survey was 1 corralled goat with direct access to the Poquoson River. Manure is left in the corral.

44. [redacted]. Dwelling- white aluminum siding 2 story. No contact. Present at time of survey were 6 pastured horses, 15 chickens in a coop and 2 pastured goats without direct access to tidal waters. Manure appears to be spread on pasture.

46. [redacted] Dwelling- brick 2 story with front porch. 3 persons. Present at time of survey were 10 pastured horses 1000 yards from the Poquoson River without direct access to tidal waters. Manure is spread onto pastures and hauled away as fertilizer.

49. [redacted]. Business- boarding stable and corrals. 8 persons. Present at time of survey were 7 pastured horses and 3 kenneled dogs 100' from tributary of Moore's Creek without direct access to tidal waters. Manure is spread to pastures or given away as fertilizer.

54. [redacted] Dwelling- white brick and frame 2 story with back shutters. 2 persons. Present at time of survey were 3 pastured horses, approximately 80 caged fowl, and 5 free roaming fowl 250' from Lambs Creek; the pastured and caged animals have no direct access to tidal waters. Manure and guano are spread on pastures or left in cages.

SUMMARY

Area #53
Poquoson River and Back Creek
May 22, 2002

SECTION B: SEWAGE POLLUTION SOURCES

1. SEWAGE TREATMENT FACILITIES

1 - DIRECT - #10
0 - INDIRECT - None
1 - B. 1. TOTAL

2. ON-SITE SEWAGE DEFICIENCIES

2 - CONTRIBUTES POLLUTION, DIRECT - #21, 23
7 - CONTRIBUTES POLLUTION, INDIRECT - #16, 17, 18, 19, 24, 29, 55

0 - CP (Kitchen or Laundry Wastes), DIRECT - None
1 - CP (Kitchen or Laundry Wastes), INDIRECT - #9

0 - NO FACILITIES, DIRECT - None
0 - NO FACILITIES, INDIRECT - None
10 - B. 2. TOTAL

3. POTENTIAL POLLUTION -

9 - POTENTIAL POLLUTION - #3, 9, 41, 42, 43, 48, 51, 52, 63
9 - B. 3. TOTAL

SECTION C: NON-SEWAGE WASTE SITES

1. INDUSTRIAL WASTE SITES

4 - DIRECT - #13, 14, 34, 58
5 - INDIRECT - #7, 28, 30, 40, 45
9 - C. 1. TOTAL

2. SOLID WASTE DUMPSITES

2 - DIRECT - #67, 68
8 - INDIRECT - #8, 27, 31, 39, 40, 53, 54, 56
10 - C. 2. TOTAL

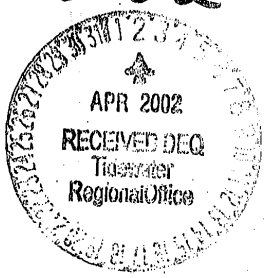
SECTION D: BOATING ACTIVITY

10 - MARINAS - #5, 11, 14, 20, 22, 35, 57, 59, 60, 66
12 - OTHER PLACES WHERE BOATS ARE MOORED - #1, 2, 4, 12, 25, 26, 34, 56, 58, 61, 62, 65
6 - UNDER SURVEILLANCE - #6, 33, 37, 47, 50, 64
10 - D. TOTAL

SECTION E: CONTRIBUTES ANIMAL POLLUTION

3 - DIRECT - #32, 34, 38
6 - INDIRECT - #15, 36, 44, 46, 49, 54
9 - E. TOTAL

7004 303 d



COMMONWEALTH of VIRGINIA

Department of Health
P O BOX 2448
RICHMOND, VA 23218

TTY 7-1-1 OR
1-800-828-1120

NOTICE AND DESCRIPTION OF SHELLFISH AREA CONDEMNATION NUMBER 137, POQUOSON RIVER

EFFECTIVE 11 APRIL 2002

Pursuant to Title 28.2, Chapter 8, §§28.2-803 through 28.2-808, §32.1-20, and §9-6.14:4.1, B.16 of the *Code of Virginia:*

1. The "Notice and Description of Shellfish Area Condemnation Number 137, Poquoson River," effective 20 November 2001, is cancelled effective 11 April 2002.

2. Condemned Shellfish Area Number 137, Poquoson River, is established, effective 11 April 2002. It shall be unlawful for any person, firm, or corporation to take shellfish from area #137 for any purpose, except by permit granted by the Marine Resources Commission, as provided in Section 28.2-810 of the *Code of Virginia.* The boundaries of the area are shown on map titled "Poquoson River, Condemned Shellfish Area Number 137, 11 April 2002" which is part of this notice.

3. The Department of Health will receive, consider and respond to petitions by any interested person at any time with respect to reconsideration or revision of this order.

BOUNDARIES OF CONDEMNED AREA NUMBER 137

A. The condemned area shall include all of the Chisman Creek and its tributaries lying upstream of a line drawn from Marine Resources Commission survey marker "K" due north to the opposite shore.

B. The condemned area shall include all of the unnamed tributary lying upstream of a line drawn the shortest distance across the mouth of the inlet located north of Marine Resources Commission survey marker "Will" on the north shore of the Poquoson River downstream of Patricks Creek.

C. The condemned area shall include all of Patricks Creek and its tributaries lying upstream of a line drawn from Marine Resources Commission survey marker "PS" on the south shore due north to the opposite shore.

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment
www.vdh.state.va.us

D. The condemned area shall include all of the Poquoson River and its tributaries lying upstream of a line drawn due east from the northern point at the mouth of Quarter March Creek to the opposite shore.

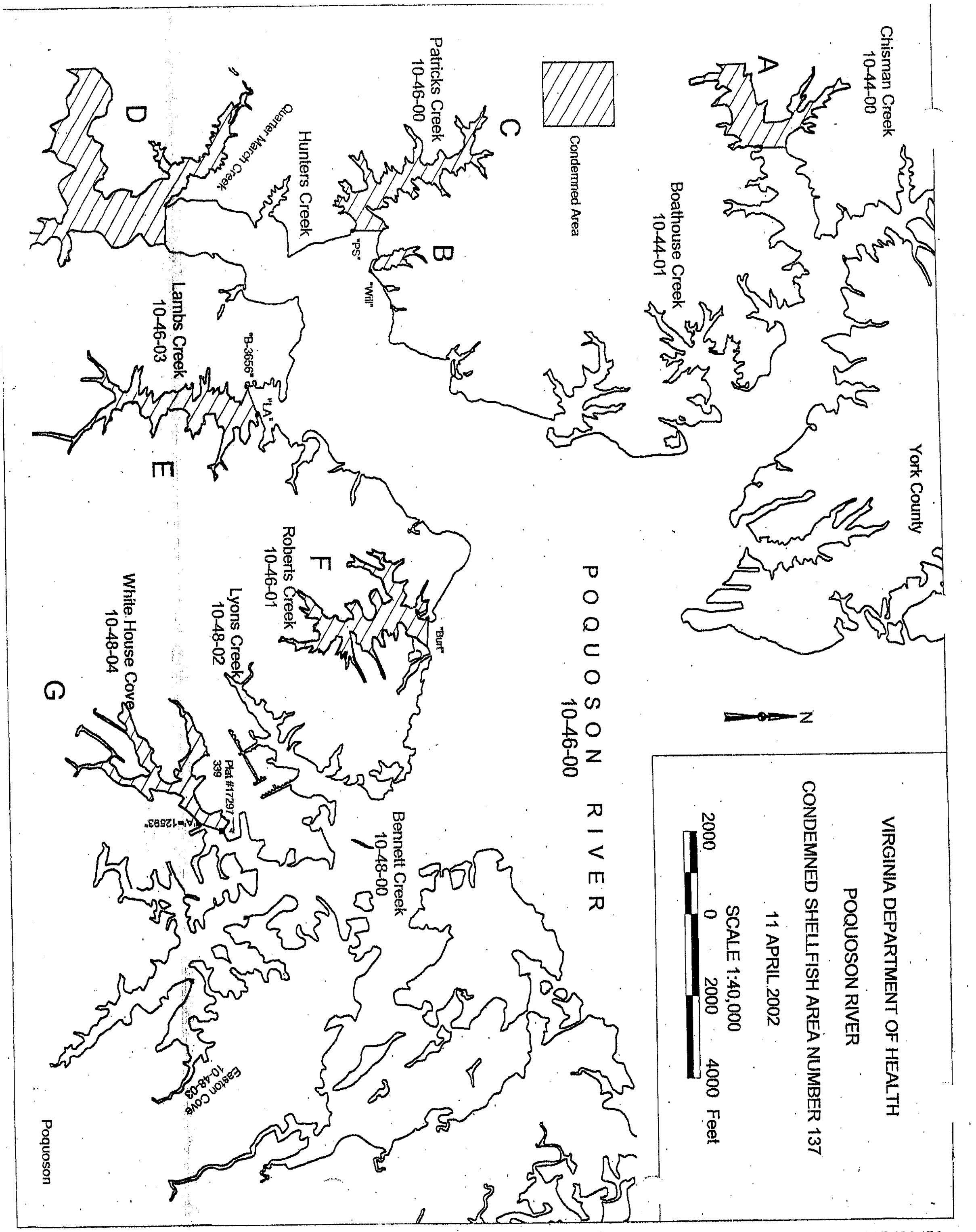
E. The condemned area shall include all of Lambs Creek and its tributaries lying upstream of a line drawn between Marine Resources Commission survey markers "LA" and "B-3656."

F. The condemned area shall include all of Roberts Creek and its tributaries lying upstream of a line drawn from Marine Resources Commission survey marker "Burt" due east to the opposite shore.

G. The condemned area shall include all of White House Cove and its tributaries lying upstream of a line drawn from Marine Resources Commission survey marker "A'=12593" through corner 339 of plat #17297 to the opposite shore.

Recommended by: _____
Director, Division of Shellfish Sanitation

Ordered by: _____ 3/28/2002
Acting State Health Commissioner Date



02/08/2006 08:22 FAX 757 518 2009 DEQ-TRO-REM-PERMITS 012

2004 3032

COMMONWEALTH of VIRGINIA

E. ANNE PETERSON, M.D., M.P.H.
STATE HEALTH COMMISSIONER

Department of Health
P O BOX 2448
RICHMOND, VA 23218

TDD 1-800-828-1120

NOTICE AND DESCRIPTION OF SHELLFISH AREA CONDEMNATION NUMBER 151, BACK CREEK - YORK COUNTY

EFFECTIVE 30 APRIL 2001

Pursuant to Title 28.2, Chapter 8, §§28.2-803 through 28.2-808, §32.1-20, and §9-6.14:4.1, B.16 of the *Code of Virginia:*

1. The "Notice and Description of Shellfish Area Condemnation Number 151, Back Creek - York County," effective 4 May 2000, is cancelled effective 30 April 2001.

2. Condemned Shellfish Area Number 151, Back Creek - York County, is established, effective 30 April 2001. It shall be unlawful for any person, firm, or corporation to take shellfish from area #151 for any purpose, except by permit granted by the Marine Resources Commission, as provided in Section 28.2-810 of the *Code of Virginia.* The boundaries of the area are shown on map titled "Back Creek - York County Condemned Shellfish Area Number 151, 30 April 2001" which is part of this notice.

3. The Department of Health will receive, consider and respond to petitions by any interested person at any time with respect to reconsideration or revision of this order.

BOUNDARIES OF CONDEMNED AREA NUMBER 151

The condemned area shall include all of Back Creek and its tributaries lying upstream of a line drawn from a point on the north shore located 750 feet upstream of Marine Resources Commission survey marker "Oil" due south to the opposite shore.

Recommended by: _____
Director, Division of Shellfish Sanitation

Ordered by: _____ 4/18/01
State Health Commissioner Date

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment
www.vdh.state.va.us

Appendix B: Supporting Documentation and Watershed Assessment

1. **Fecal Production Literature Review**
2. **Steady State Tidal Prism Model**
3. **Geographic Information System Data: Sources and Process**
4. **Watershed Source Assessment**

Table B-1 GIS Data Elements and Sources

Data Element	Source	Date
Watershed boundary	Division of Shellfish Sanitation, VA Department of Health	Various dates
Subwatershed boundary	Center for Coastal Resources Management	2003
Land use	National Land Cover Data set (NLCD), US Geological Survey	1999
Elevation	Digital Elevation Models and Digital Raster Graphs, US Geological Survey	Various dates
Soils	SSURGO and STATSGO, National Resource Conservation Service	Various dates
Stream network	National Hydrography Dataset	1999
Precipitation, temperature, solar radiation, and evapotranspiration	Chesapeake Bay Program, Phase V	2002
Stream flow data	Gauging stations, US Geological Survey	Various dates
Shoreline Sanitary Survey deficiencies	Division of Shellfish Sanitation, VA Department of Health	Various dates
Wastewater treatment plants	VA Department of Environmental Quality	Various dates
Sewers	Division of Shellfish Sanitation, VA Department of Health	Various dates
Dog population	US Census Bureau American Veterinary Association	2000 2002
Domestic livestock	National Agricultural Statistics Service, USDA	1997/2001
Wildlife	Virginia Department of Game and Inland Fisheries, US Fish and Wildlife Service	2004 2004
Septic tanks (from human population)	Division of Shellfish Sanitation, VA Department of Health US Census Bureau	Various dates 2000
Water quality monitoring stations	Division of Shellfish Sanitation, VA Department of Health	Various dates
Water quality segments	Center for Coastal Resources Management	2003
Tidal prism segments	Department of Physical Sciences, VIMS	2003
Water body volumes	Bathymetry from Hydrographic Surveys, National Ocean Service, NOAA	Various dates
Condemnation zones	Division of Shellfish Sanitation, VA Department of Health	Various dates
Tidal data	NOAA tide tables	2004

A. GIS Data Description and Process

Watershed boundary determined by VDH, DSS. There are 105 watersheds in Virginia.

Subwatershed boundaries were delineated based on elevation, using digital 7.5 minute USGS topographic maps. There are 1836 subwatersheds.

The original land use has 15 categories that were combined into 3 categories:
urban (high and low density residential and commercial);
undeveloped (forest and wetlands); and
agriculture (pasture and crops).

Descriptions of Shoreline Sanitary Survey deficiencies are found in each report. Contact DSS for more information. Digital data layer generated by CCRM from hardcopy reports.

Wastewater treatment plant locations were obtained from DEQ and digital data layer was generated by CCRM. Design flow, measured flow, and fecal coliform discharges were obtained from DEQ.

Sewers data layer was digitized from Shoreline Sanitary Surveys by CCRM.

Dog numbers were obtained using the American Vet Associations equation of #households * 0.58. See website for additional information—
http://www.avma.org/membshp/marketstats/formulas.asp#households1.
Database was generated by CCRM.

Domestic livestock includes cows, pigs, sheep, chickens, turkeys, and horses. Database was generated by CCRM.

Wildlife includes ducks and geese, deer, and raccoons. Animals were chosen based on availability of fecal coliform production rates and population estimates. Database was generated by CCRM.
Ducks and geese–US FWS, DGIF
Deer–DGIF
Raccoons–DGIF

Human input was based on DSS sanitary survey deficiencies and US Census Bureau population data (number of households).

Water quality monitoring data are collected, on average, once per month. Digital data layer of locations was generated by DSS. Water quality data was mathematically processed and input into a database for model use.

Water bodies were divided into segments based on the location of the monitoring stations (midway between stations). If a segment contained >1 station, the FC values were averaged. If a segment contained 0 stations, the value from the closest station(s) was assigned to it. Digital data layer of segments was generated by CCRM. FC loadings in the water were obtained by multiplying FC concentrations by segment volume.

Bathymetry data were used to generate a depth grid that was used to estimate volumes for each water quality segment and tidal prism segment.

The 1998 303d report was used to set the list of condemnation zones that require TMDLs. The digital data layer was generated by CCRM from hardcopy closure reports supplied by DSS.

B. Population Numbers

The process used to generate population numbers used for the nonpoint source contribution analysis part of the watershed model for the four source categories: human, livestock, pets and wildlife is described for each below.

Human:

The number of people contributing fecal coliform from failing septic tanks were developed in two ways and then compared to determine a final value.

1) Deficiencies (septic failures) from the DSS shoreline surveys were counted for each watershed and multiplied by 3 (average number of people per household).
2) Numbers of households in each watershed were determined from US Census Bureau data. The numbers of households were multiplied by 3 (average number of people per household) to get the total number of people and then multiplied by a septic failure rate* to get number of people contributing fecal coliform from failing septic tanks.

*The septic failure rate was estimated by dividing the number of deficiencies in the watershed by the total households in the watershed. The average septic failure rate was 12% and this was used as the default unless the DSS data indicated that septic failure was higher.

Livestock:

US Census Bureau data was used to calculate the livestock values. The numbers for each type of livestock (cattle, pigs, sheep, chickens (big and small), and horses) were reported by county. Each type of livestock was assigned to the land use(s) it lives on, or contributes to by the application of manure, as follows:

Cattle	cropland and pastureland
Pigs	cropland
Sheep	pastureland
Chickens	cropland
Horses	pastureland

GIS was used to overlay data layers for several steps:

1) The county boundaries and the land uses to get the area of each land use in each county. The number of animals was divided by the area of each land use for the county to get an animal density for each county.
2) The subwatershed boundaries and the land uses to get the area of each land use in each subwatershed.
3) The county boundaries and the subwatershed boundaries to get the area of each county in each subwatershed. If a subwatershed straddled more than one county, the areal proportion of each county in the subwatershed was used to determine the number of animals in the subwatershed.

Using MS Access, for each type of livestock, the animal density by county was multiplied by the area of each land use by county in each subwatershed to get the number of animals in each subwatershed. If more than one county was present in a subwatershed, the previous step was done for each county in the subwatershed, then summed for a total number of animals in the subwatershed. The number of animals in each subwatershed was summed to get the total number of animals in each watershed.

Pets:

The dog population was calculated using a formula for estimating the number of pets using national percentages, reported by the American Veterinary Association:

dogs = # of households * 0.58.

US Census Bureau data provided the number of households by county. The number of dogs per county was divided by the area of the county to get a dog density per county. GIS was used to overlay the subwatershed boundaries with the county boundaries to get the area of each county in a subwatershed. If a subwatershed straddled more than one county, the areal proportion of each county in the subwatershed was calculated. Using MS Access, the area of each county in the subwatershed was multiplied by the dog density per county to get the number of dogs per subwatershed. If more than one county was present in a subwatershed, the previous step was done for each county in the subwatershed, then summed for a total number of dogs in the subwatershed. The number of dogs in each subwatershed was summed to get the total number of dogs in each watershed.

Wildlife:

Deer—

The number of deer were calculated using information supplied by DGIF, consisting of an average deer index by county and the formula:

#deer/mi^2 of deer habitat = (-0.64 + (7.74 * average deer index)).

Deer habitat consists of forests, wetlands, and agricultural lands (crop and pasture). GIS was used to overlay data layers for the following steps:

1) The county boundaries and the subwatershed boundaries to get the area of each county in each subwatershed. If a subwatershed straddled more than one county, the areal proportion of each county in the subwatershed was calculated.
2) The subwatershed boundaries and the deer habitat to get the area of deer habitat in each subwatershed.

Using MS Access, number of deer in each subwatershed were calculated by multiplying the #deer/mi^2 of deer habitat times the area of deer habitat. If more than one county was present in a subwatershed, the previous step was done for each county in the subwatershed, then summed for a total number of deer in the subwatershed. The number of deer in each subwatershed was summed to get the total number of deer in each watershed.

Ducks and Geese—

The data for ducks and geese were divided into summer (April through September) and winter (October through March).

Summer

The summer numbers were obtained from the Breeding Bird Population Survey (US Fish and Wildlife Service) and consisted of bird densities (ducks and geese) for 3 regions: the southside of the James River, the rest of the tidal areas, and the salt marshes in both areas. The number of ducks and geese in the salt marshes were distributed into the other 2 regions based on the areal proportion of salt marshes in them using the National Wetland Inventory data and GIS.

Winter

The winter numbers were obtained from the Mid-Winter Waterfowl Survey (US Fish and Wildlife Service) and consisted of population numbers for ducks and geese in several different areas in the tidal region of Virginia. MS Access was used to calculate the total number of ducks and geese in each area and then these numbers were grouped to match the 2 final regions (Southside and the rest of tidal Virginia) for the summer waterfowl populations. Winter populations were an order of magnitude larger than summer populations.

Data from DGIF showed the spatial distribution of ducks and geese for 1993 and 1994. Using this information and GIS a 250m buffer on each side of the shoreline was generated and contained 80% of the birds. Wider buffers did not incorporate significantly more birds, since they were located too far inland. GIS was used to overlay the buffer and the watershed boundaries to calculate the area of buffer in each watershed. To distribute this information into each subwatershed, GIS was used to calculate the length of shoreline in each subwatershed and the total length of shoreline in the watershed. Dividing the length of shoreline in each subwatershed by the total length of shoreline gives a ratio that was multiplied by the area of the watershed to get an estimate of the area of buffer in each subwatershed. MS Excel was used to multiply the area of buffer in each subwatershed times the total numbers of ducks and geese to get the numbers of ducks and geese in each subwatershed. These numbers were summed to get the total number of ducks and geese in each watershed. To get annual populations, the totals then were divided by 2, since they represent only 6 months of habitation (this reduction underestimates the total annual input from ducks and geese, but is the easiest conservative method to use since the model does not have a way to incorporate the seasonal differences).

Raccoons—

Estimates for raccoon densities were supplied by DGIF for 3 habitats—wetlands (including freshwater and saltwater, forested and herbaceous), along streams, and upland forests. GIS was used to generate a 600ft buffer around the wetlands and streams, and then to overlay this buffer layer with the subwatershed boundaries to get the area of the buffer in each subwatershed. GIS was used to overlay the forest layer with the subwatershed boundaries to get the area of forest in each subwatershed. MS Access was used to multiply the raccoon densities for each habitat times the area of each habitat in each subwatershed to get the number of raccoons in each habitat in each subwatershed. The number of raccoons in each subwatershed was summed to get the total number of raccoons in each watershed.

B-4. Watershed Source Assessment

The watershed assessment calculates fecal coliform loads by source based on geographic information system data. A geographic information system is a powerful computer software package that can store large amounts of spatially referenced data and associated tabular information. The data layers produced by a GIS can be used for many different tasks, such as generating maps, analyzing results, and modeling processes. The watershed model requires a quantitative assessment of human sewage sources (i. e., malfunctioning septic systems) and animal (livestock, pets and wildlife) fecal sources distributed within each watershed.

The fecal coliform contribution from livestock is through the manure spreading processes and direct deposition during grazing. This contribution was initially estimated based on land use data and the livestock census data. In the model, manure was applied to both cropland and pasture land depending on the grazing period. Figure B-1 shows a diagram of the procedure for estimating the total number of livestock in the watershed and fecal coliform production. A description of the process used to determine the source population values for wildlife, pets and human used in the calculation of percent loading is found in Appendix B.

FIGURE B-1 Diagram to Illustrate Procedure Used to Estimate Fecal Coliform Production from Estimated Livestock Population

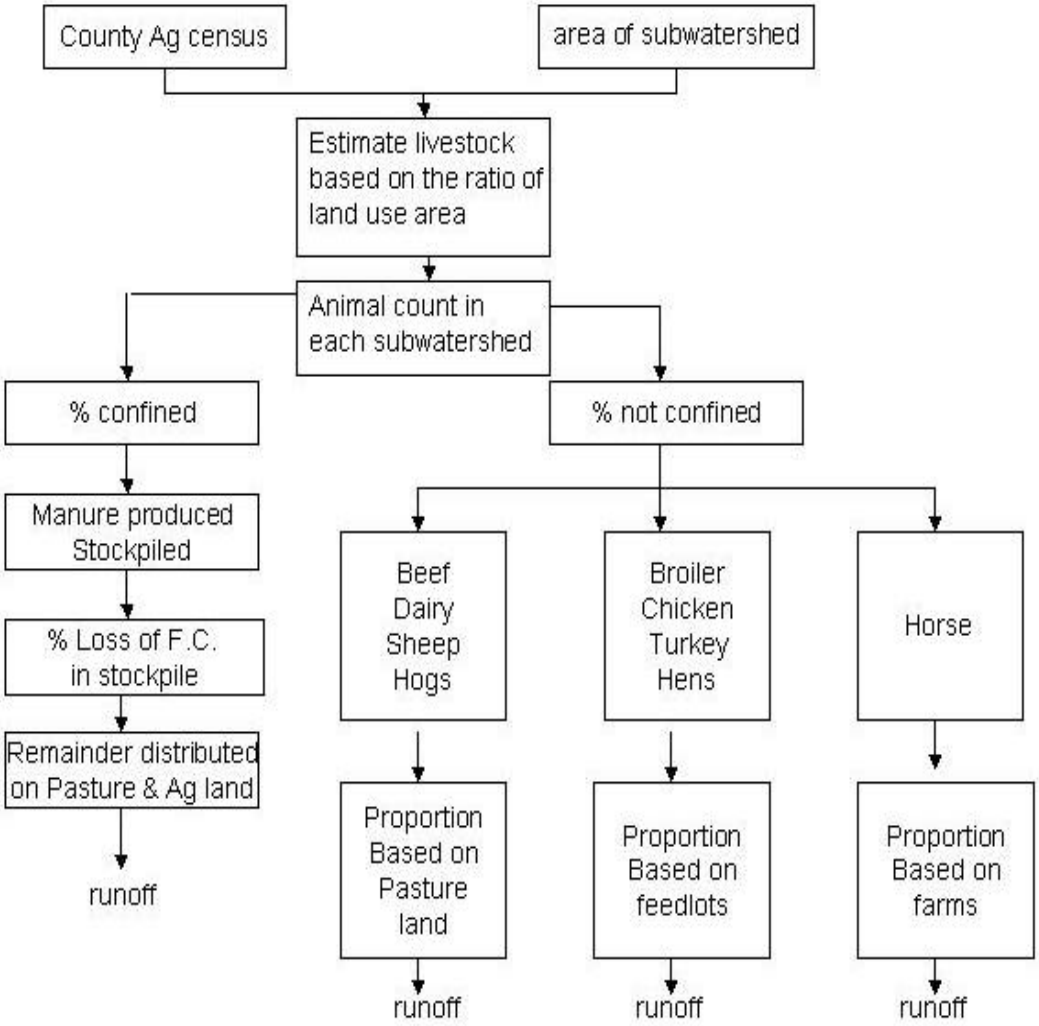


Table B-2 Nonpoint Source Load Distribution by Condemned Area Using Watershed Model: Growing Area 53

Condemned Area	Livestock	Wildlife	Human	Pet
137A Chisman Creek	21.67%	38.65%	2.24%	37.45%
137C Patricks Creek	28.76%	26.85%	2.51%	41.89%
137D Poquoson River	11.69%	41.39%	2.65%	44.27%
137E Lambs Creek	0.00%	68.41%	1.78%	29.81%
137 F Roberts Creek	0.00%	72.91%	1.53%	25.56%
137G Whitehouse Creek	0.00%	62.33%	2.13%	35.54%
151 Back Creek	11.19%	44.45%	2.50%	41.86%

Appendix C: Water Quality Data Summary

Observed Geometric Mean and 90th Percentile By Condemned Area

Condemned Area	Mean of Geometric Means	SD Geometric Means	Mean of the 90th Means	SD 90th Means	Last 30 Sample Geo mean	Last 30 Sample 90th
137A Chisman Creek	**23.1**	**6.2**	**182.8**	**78.0**	**13.4**	**79.1**
137C Patricks Creek	**23.4**	**5.3**	**148.9**	**43.7**	**14.2**	**97.8**
137D Poquoson River	**27.6**	**7.0**	**203.4**	**75.0**	**17.4**	**132.7**
137E Lambs Creek	**12.1**	**3.2**	**96.2**	**42.8**	**13.3**	**164.3**
137 F Roberts Creek	**10.6**	**2.7**	**62.9**	**24.5**	**7.5**	**41.4**
137G Whitehouse Creek	**24.4**	**7.8**	**186.9**	**74.7**	**15.6**	**122.4**
151 Back Creek	**14.1**	**4.9**	**91.7**	**58.1**	**8.6**	**48.3**

Appendix D

1) Code of Virginia §62.1-194.1 Obstructing or contaminating state waters.
2) Code of Federal Regulations. Title 33, Volume 2, Parts 120 to 1999 Revised as of July 1, 2000

D1: Code of Virginia §62.1-194.1

§62.1-194.1. Obstructing or contaminating state waters.

Except as otherwise permitted by law, it shall be unlawful for any person to dump, place or put, or cause to be dumped, placed or put into, upon the banks of or into the channels of any state waters any object or substance, noxious or otherwise, which may reasonably be expected to endanger, obstruct, impede, contaminate or substantially impair the lawful use or enjoyment of such waters and their environs by others. Any person who violates any provision of this law shall be guilty of a misdemeanor and upon conviction be punished by a fine of not less than $100 nor more than $500 or by confinement in jail not more than twelve months or both such fine and imprisonment. Each day that any of said materials or substances so dumped, placed or put, or caused to be dumped, placed or put into, upon the banks of or into the channels of, said streams shall constitute a separate offense and be punished as such. In addition to the foregoing penalties for violation of this law, the judge of the circuit court of the county or corporation court of the city wherein any such violation occurs, whether there be a criminal conviction therefor or not shall, upon a bill in equity, filed by the attorney for the Commonwealth of such county or by any person whose property is damaged or whose property is threatened with damage from any such violation, award an injunction enjoining any violation of this law by any person found by the court in such suit to have violated this law or causing the same to be violated, when made a party defendant to such suit. (1968, c. 659.)

D2: Code of Federal Regulations. Title 33, Volume 2, Parts 120 to 1999 Revised as of July 1, 2000 From the U.S. Government Printing Office via GPO Access [CITE: 33CFR159]

NAVIGABLE WATERS

CHAPTER I--COAST GUARD, DEPARTMENT OF TRANSPORTATION (CONTINUED)

PART 159--MARINE SANITATION DEVICES

Subpart A--General

Sec.

Subpart B--Certification Procedures

Subpart C--Design, Construction, and Testing

Subpart D--Recognition of Facilities

Authority: Sec. 312(b)(1), 86 Stat. 871 (33 U.S.C. 1322(b)(1)); 49 CFR 1.45(b) and 1.46(l) and (m).

Source: CGD 73-83, 40 FR 4624, Jan. 30, 1975, unless otherwise noted.

Subpart A--General

Sec. 159.1 Purpose.

This part prescribes regulations governing the design and construction of marine sanitation devices and procedures for certifying that marine sanitation devices meet the regulations and the standards of the Environmental Protection Agency promulgated under section 312 of the Federal Water Pollution

Control Act (33 U.S.C. 1322), to eliminate the discharge of untreated sewage from vessels into the waters of the United States, including the territorial seas. Subpart A of this part contains regulations governing the manufacture and operation of vessels equipped with marine sanitation devices.

Sec. 159.3 Definitions.

In this part:
Coast Guard means the Commandant or his authorized representative.
Discharge includes, but is not limited to, any spilling, leaking, pouring, pumping, emitting, emptying, or dumping.
Existing vessel includes any vessel, the construction of which was initiated before January 30, 1975.
Fecal coliform bacteria are those organisms associated with the intestine of warm-blooded animals that are commonly used to indicate the presence of fecal material and the potential presence of organisms capable of causing human disease.
Inspected vessel means any vessel that is required to be inspected under 46 CFR Ch. I.
Length means a straight line measurement of the overall length from the foremost part of the vessel to the aftermost part of the vessel, measured parallel to the centerline. Bow sprits, bumpkins, rudders, outboard motor brackets, and similar fittings or attachments are not to be included in the measurement.
Manufacturer means any person engaged in manufacturing, assembling, or importing of marine sanitation devices or of vessels subject to the standards and regulations promulgated under section 312 of the Federal Water Pollution Control Act.
Marine sanitation device and device includes any equipment for installation on board a vessel which is designed to receive, retain, treat, or discharge sewage, and any process to treat such sewage.
New vessel includes any vessel, the construction of which is initiated on or after January 30, 1975.
Person means an individual, partnership, firm, corporation, or association, but does not include an individual on board a public vessel.
Public vessel means a vessel owned or bare-boat chartered and operated by the United States, by a State or political subdivision thereof, or by a foreign nation, except when such vessel is engaged in commerce.
Recognized facility means any laboratory or facility listed by the Coast Guard as a recognized facility under this part.
Sewage means human body wastes and the wastes from toilets and other receptacles intended to receive or retain body waste.
Territorial seas means the belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of 3 miles.
Type I marine sanitation device means a device that, under the test conditions described in Secs. 159.123 and 159.125, produces an effluent having a fecal coliform bacteria count not greater than 1,000 per 100 milliliters and no visible floating solids.
Type II marine sanitation device means a device that, under the test conditions described in Secs. 159.126 and 159.126a, produces an effluent having a fecal coliform bacteria count not greater than 200 per 100 milliliters and suspended solids not greater than 150 milligrams per liter.
Type III marine sanitation device means a device that is designed to prevent the overboard discharge of treated or untreated sewage or any waste derived from sewage.
Uninspected vessel means any vessel that is not required to be inspected under 46 CFR Chapter I.

United States includes the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Canal Zone, and the Trust Territory of the Pacific Islands.
Vessel includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on the waters of the United States.

[CGD 96-026, 61 FR 33668, June 28, 1996, as amended by CGD 95-028, 62 FR 51194, Sept. 30, 1997]

Sec. 159.4 Incorporation by reference.

(a) Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in paragraph (b) of this section, the Coast Guard must publish notice of change in the Federal Register; and the material must be available to the public.
All approved material is available for inspection at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC, and at the U.S. Coast Guard Office of Design and Engineering Standards (G-MSE), 2100 Second Street SW., Washington, DC 20593-0001, and is available from the sources indicated in paragraph (b) of this section.
(b) The material approved for incorporation by reference in this part, and the sections affected, are as follows:

American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 11-95, Standard Specification for Wire Cloth and Sieves for Testing Purposes--159.125

[USCG-1999-5151, 64 FR 67176, Dec. 1, 1999]

Sec. 159.5 Requirements for vessel manufacturers.

No manufacturer may manufacture for sale, sell, offer for sale, or distribute for sale or resale any vessel equipped with installed toilet facilities unless it is equipped with:
(a) An operable Type II or III device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12 or Sec. 159.12a; or
(b) An operable Type I device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12, if the vessel is 19.7 meters (65 feet) or less in length.

[CGD 95-028, 62 FR 51194, Sept. 30, 1997]

Sec. 159.7 Requirements for vessel operators.

(a) No person may operate any vessel equipped with installed toilet facilities unless it is equipped with:
(1) An operable Type II or III device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12 or Sec. 159.12a; or

(2) An operable Type I device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12, if the vessel is 19.7 meters (65 feet) or less in length.

(b) When operating a vessel on a body of water where the discharge of treated or untreated sewage is prohibited by the Environmental Protection Agency under 40 CFR 140.3 or 140.4, the operator must secure each Type I or Type II device in a manner which prevents discharge of treated or untreated sewage. Acceptable methods of securing the device include--

(1) Closing the seacock and removing the handle;

(2) Padlocking the seacock in the closed position;

(3) Using a non-releasable wire-tie to hold the seacock in the closed position; or

(4) Locking the door to the space enclosing the toilets with a padlock or door handle key lock.

(c) When operating a vessel on a body of water where the discharge of untreated sewage is prohibited by the Environmental Protection Agency under 40 CFR 140.3, the operator must secure each Type III device in a
manner which prevents discharge of sewage. Acceptable methods of securing the device include--

(1) Closing each valve leading to an overboard discharge and removing the handle;

(2) Padlocking each valve leading to an overboard discharge in the closed position; or

(3) Using a non-releasable wire-tie to hold each valve leading to an overboard discharge in the closed position.

[CGH 95-028, 62 FR 51194, Sept. 30, 1997]

Subpart B--Certification Procedures

Sec. 159.11 Purpose.

This subpart prescribes procedures for certification of marine sanitation devices and authorization for labels on certified devices.

Sec. 159.12 Regulations for certification of existing devices.

(a) The purpose of this section is to provide regulations for certification of existing devices until manufacturers can design and manufacture devices that comply with this part and recognized facilities are prepared to perform the testing required by this part.

(b) Any Type III device that was installed on an existing vessel before January 30, 1975, is considered certified.

(c) Any person may apply to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001 for certification of a marine sanitation device manufactured before January 30, 1976. The Coast Guard will issue a letter certifying the device if the applicant shows that the device meets Sec. 159.53 by:

(1) Evidence that the device meets State standards at least equal to the standards in Sec. 159.53, or

(2) Test conducted under this part by a recognized laboratory, or

(3) Evidence that the device is substantially equivalent to a device certified under this section, or

(4) A Coast Guard field test if considered necessary by the Coast Guard.

(d) The Coast Guard will maintain and make available a list that identifies each device certified under this section.

(e) Devices certified under this section in compliance with Sec. 159.53 need not meet the other regulations in this part and may not be labeled under Sec. 159.16.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976; CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Sec. 159.12a Certification of certain Type III devices.

(a) The purpose of this section is to provide regulations for certification of certain Type III devices.

(b) Any Type III device is considered certified under this section if:

(1) It is used solely for the storage of sewage and flushwater at ambient air pressure and temperature; and

(2) It is in compliance with Sec. 159.53(c).

(c) Any device certified under this section need not comply with the other regulations in this part except as required in paragraphs (b)(2)and (d) of this section and may not be labeled under Sec. 159.16.

d) Each device certified under this section which is installed aboard an inspected vessel must comply with Sec. 159.97.

[CGD 76-145, 42 FR 11, Jan. 3, 1977]

Sec. 159.14 Application for certification.

(a) Any manufacturer may apply to any recognized facility for certification of a marine sanitation device. The application for certification must indicate whether the device will be used aboard all vessels or only aboard uninspected vessels and to which standard in Sec. 159.53 the manufacturer requests the device to be tested.

(b) An application may be in any format but must be in writing and must be signed by an authorized representative of the manufacturer and include or be accompanied by:

(1) A complete description of the manufacturer's production quality control and inspection methods, record keeping systems pertaining to the manufacture of marine sanitation devices, and testing procedures;

(2) The design for the device, including drawings, specifications and other information that describes the materials, construction and operation of the device;

(3) The installation, operation, and maintenance instructions for the device; and

(4) The name and address of the applicant and the manufacturing facility.

(c) The manufacturer must furnish the recognized facility one device of each model for which certification is requested and samples of each material from which the device is constructed, that must be tested destructively under Sec. 159.117. The device furnished is for the testing required by this part except that, for devices that are not suited for unit testing, the manufacturer may submit the design so that the recognized facility may determine the components of the device and materials to be submitted for testing and the tests to be performed at a place other than the facility. The

Coast Guard must review and accept all such determinations before testing is begun.

(d) At the time of submittal of an application to a recognized facility the manufacturer must notify the Coast Guard of the type and model of the device, the name of the recognized facility to which application is being made, and the name and address of the manufacturer, and submit a signed statement of the times when the manufacturer will permit designated officers and employees of the Coast Guard to have access to the manufacturer's facilities and all records required by this part.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.15 Certification.

(a) The recognized facility must evaluate the information that is submitted by the manufacturer in accordance with Sec. 159.14(b) (1), (2), and (3), evaluate the device for compliance with Secs. 159.53 through 159.95, test the device in accordance with Sec. 159.101 and submit to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C.
20593-0001 the following:

(1) The information that is required under Sec. 159.14(b);

(2) A report on compliance evaluation;

(3) A description of each test;

(4) Test results; and

(5) A statement, that is signed by the person in charge of testing, that the test results are accurate and complete.

(b) The Coast Guard certifies a test device, on the design of the device, if it determines, after consideration of the information that is required under paragraph (a) of this section, that the device meets the requirements in Subpart C of this part.

(c) The Coast Guard notifies the manufacturer and recognized facility of its determination under paragraph (b) of this section. If the device is certified, the Coast Guard includes a certification number for the device. If certification is denied, the Coast Guard notifies the manufacturer and recognized facility of the requirements of this part that are not met. The manufacturer may appeal a denial to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001.

(d) If upon re-examination of the test device, the Coast Guard determines that the device does not in fact comply with the requirements of Subpart C of this part, it may terminate the certification.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976; CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Sec. 159.16 Authorization to label devices.

(a) When a test device is certified under Sec. 159.15(b), the Coast Guard will issue a letter that authorizes the manufacturer to label each device that he manufactures with the manufacturer's certification that the device is in all material respects substantially the same as a test device certified by the U.S. Coast Guard pursuant to section 312 of the Federal Water Pollution Control Act Amendments of 1972.

(b) Certification placed on a device by its manufacturer under this section is the certification required by section 312(h)(4) of the Federal Water Pollution Control Act Amendments of 1972, which makes it unlawful for a vessel that is subject to the standards and regulations promulgated under the Act to operate on the navigable waters of the United States, if such vessel is not equipped with an operable marine sanitation device certified pursuant to section 312 of the Act.

(c) Letters of authorization issued under this section are valid for 5 years, unless sooner suspended, withdrawn, or terminated and may be reissued upon written request of the manufacturer to whom the letter was issued.

(d) The Coast Guard, in accordance with the procedure in 46 CFR 2.75, may suspend, withdraw, or terminate any letter of authorization issued under this section if the Coast Guard finds that the manufacturer is engaged in the manufacture of devices labeled under this part that are not in all material respects substantially the same as a test device certified pursuant to this part.

Sec. 159.17 Changes to certified devices.

(a) The manufacturer of a device that is certified under this part shall notify the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001 in writing of any change in the design of the device.

(b) A manufacturer shall include with a notice under paragraph (a) of this section a description of the change, its advantages, and the recommendation of the recognized facility as to whether the device remains in all material respects substantially the same as the original test device.

(c) After notice under paragraph (a) of this section, the Coast Guard notifies the manufacturer and the recognized facility in writing of any tests that must be made for certification of the device or for any change in the letter of authorization. The manufacturer may appeal this determination to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Sec. 159.19 Testing equivalency.

(a) If a test required by this part may not be practicable or necessary, a manufacturer may apply to the Commandant (G-MSE), U.S. Coast Guard, Washington, DC 20593-0001 for deletion or approval of an alternative test as equivalent to the test requirements in this part. The application must include the manufacturer's justification for deletion or the alternative test and any alternative test data.

(b) The Coast Guard notifies the manufacturer of its determination under paragraph (a) of this section and that determination is final.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Subpart C--Design, Construction, and Testing

Sec. 159.51 Purpose and scope.

(a) This subpart prescribes regulations governing the design and construction of marine sanitation devices.

(b) Unless otherwise authorized by the Coast Guard each device for which certification under this part is requested must meet the requirements of this subpart.

Sec. 159.53 General requirements.

A device must:

(a) Under the test conditions described in Secs. 159.123 and 159.125, produce an effluent having a fecal coliform bacteria count not greater than 1,000 per 100 milliliters and no visible floating solids (Type I),

(b) Under the test conditions described in Secs. 159.126 and 159.126a, produce an effluent having a fecal coliform bacteria count not greater than 200 per 100 milliliters and suspended solids not greater than 150 milligrams per liter (Type II), or

(c) Be designed to prevent the overboard discharge of treated or untreated sewage or any waste derived from sewage (Type III).

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.55 Identification.

(a) Each production device must be legibly marked in accordance with paragraph (b) of this section with the following information:

(1) The name of the manufacturer.

(2) The name and model number of the device.

(3) The month and year of completion of manufacture.

(4) Serial number.

(5) Whether the device is certified for use on an inspected or an uninspected vessel.

(6) Whether the device is Type I, II, or III.

(b) The information required by paragraph (a) of this section must appear on a nameplate attached to the device or in lettering on the device. The nameplate or lettering stamped on the device must be capable of withstanding without loss of legibility the combined effects of normal wear and tear and exposure to water, salt spray, direct sunlight, heat, cold, and any substance listed in Sec. 159.117(b) and (c). The nameplate and lettering must be designed to resist efforts to remove them from the device or efforts to alter the information stamped on the nameplate or the device without leaving some obvious evidence of the attempted removal or alteration.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.57 Installation, operation, and maintenance instructions.

(a) The instructions supplied by the manufacturer must contain directions for each of the following:

(1) Installation of the device in a manner that will permit ready access to all parts of the device requiring routine service and that will provide any flue clearance necessary for fire safety.

(2) Safe operation and servicing of the device so that any discharge meets the applicable requirements of Sec. 159.53.

(3) Cleaning, winter layup, and ash or sludge removal.

(4) Installation of a vent or flue pipe.

(5) The type and quantity of chemicals that are required to operate the device, including instructions on the proper handling, storage and use of these chemicals.

(6) Recommended methods of making required plumbing and electrical connections including fuel connections and supply circuit overcurrent protection.

(b) The instructions supplied by the manufacturer must include the following information:

(1) The name of the manufacturer.

(2) The name and model number of the device.

(3) Whether the device is certified for use on an inspected, or uninspected vessel.

(4) A complete parts list.

(5) A schematic diagram showing the relative location of each part.

(6) A wiring diagram.

(7) A description of the service that may be performed by the user without coming into contact with sewage or chemicals.

(8) Average and peak capacity of the device for the flow rate, volume, or number of persons that the device is capable of serving and the period of time the device is rated to operate at peak capacity.

(9) The power requirements, including voltage and current.

(10) The type and quantity of fuel required.

(11) The duration of the operating cycle for unitized incinerating devices.

(12) The maximum angles of pitch and roll at which the device operates in accordance with the applicable requirements of Sec. 159.53.

(13) Whether the device is designed to operate in salt, fresh, or brackish water.

(14) The maximum hydrostatic pressure at which a pressurized sewage retention tank meets the requirements of Sec. 159.111.

(15) The maximum operating level of liquid retention components.

(16) Whether the device is Type I, II, or III.

(17) A statement as follows:

Note: The EPA standards state that in freshwater lakes, freshwater reservoirs or other freshwater impoundments whose inlets or outlets are such as to prevent the ingress or egress by vessel traffic subject to this regulation, or in rivers not capable of navigation by interstate vessel traffic subject to this regulation, marine sanitation devices certified by the U.S. Coast Guard installed on all vessels shall be designed and operated to prevent the overboard discharge of sewage,
treated or untreated, or of any waste derived from sewage. The EPA standards further state that this shall not be construed to prohibit the carriage of Coast Guard-certified flow-through treatment devices which have been secured so as to prevent such discharges. They also state that waters where a Coast Guard-certified marine sanitation device permitting discharge is allowed include coastal waters and estuaries, the Great Lakes and interconnected waterways, freshwater lakes and impoundments accessible through locks, and other flowing waters that are navigable interstate by vessels subject to this regulation (40 CFR 140.3).

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.59 Placard.

Each device must have a placard suitable for posting on which is printed the operating instructions, safety precautions, and warnings pertinent to the device. The size of the letters printed on the placard must be one-eighth of an inch or larger.

Sec. 159.61 Vents.

Vents must be designed and constructed to minimize clogging by either the contents of the tank or climatic conditions such as snow or ice.

Sec. 159.63 Access to parts.

Each part of the device that is required by the manufacturer's instructions to be serviced routinely must be readily accessible in the installed position of the device recommended by the manufacturer.

Sec. 159.65 Chemical level indicator.

The device must be equipped with one of the following:

(a) A means of indicating the amount in the device of any chemical that is necessary for its effective operation.

(b) A means of indicating when chemicals must be added for the proper continued operation of the device.

Sec. 159.67 Electrical component ratings.

Electrical components must have current and voltage ratings equal to or greater than the maximum load they may carry.

Sec. 159.69 Motor ratings.

Motors must be rated to operate at 50 deg.C ambient temperature.

Sec. 159.71 Electrical controls and conductors.

Electrical controls and conductors must be installed in accordance with good marine practice. Wire must be copper and must be stranded. Electrical controls and conductors must be protected from exposure to chemicals and sewage.

Sec. 159.73 Conductors.

Current carrying conductors must be electrically insulated from non-current carrying metal parts.

Sec. 159.75 Overcurrent protection.

Overcurrent protection must be provided within the unit to protect subcomponents of the device if the manufacturer's recommended supply circuit overcurrent protection is not adequate for these subcomponents.

Sec. 159.79 Terminals.

Terminals must be solderless lugs with ring type or captive spade ends, must have provisions for being locked against movement from vibration, and must be marked for identification on the wiring diagram required in Sec. 159.57. Terminal blocks must be nonabsorbent and securely mounted. Terminal blocks must be provided with barrier insulation that prevents contact between adjacent terminals or metal surfaces.

Sec. 159.81 Baffles.

Baffles in sewage retention tanks, if any, must have openings to allow liquid and vapor to flow freely across the top and bottom of the tank.

Sec. 159.83 Level indicator.

Each sewage retention device must have a means of indicating when the device is more than \3/4\ full by volume.

Sec. 159.85 Sewage removal.

The device must be designed for efficient removal of nearly all of the liquid and solids in the sewage retention tank.

Sec. 159.87 Removal fittings.

If sewage removal fittings or adapters are provided with the device, they must be of either 1\1/2\" or 4" nominal pipe size.

Sec. 159.89 Power interruption: Type I and II devices.

A discharge device must be designed so that a momentary loss of power during operation of the device does not allow a discharge that does not meet the requirements in Sec. 159.53.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.93 Independent supporting.

The device must have provisions for supporting that are independent from connecting pipes.

Sec. 159.95 Safety.

(a) Each device must--

(1) Be free of design defects such as rough or sharp edges that may cause bodily injuries or that would allow toxic substances to escape to the interior of the vessel;

(2) Be vented or provided with a means to prevent an explosion or over pressurization as a result of an accumulation of gases; and

(3) Meet all other safety requirements of the regulations applicable to the type of vessel for which it is certified.

(b) A chemical that is specified or provided by the manufacturer for use in the operation of a device and is defined as a hazardous material in 46 CFR Part 146 must be certified by the procedures in 46 CFR Part 147.

(c) Current carrying components must be protected from accidental contact by personnel operating or routinely servicing the device. All current carrying components must as a minimum be of drip-proof construction or be enclosed within a drip-proof compartment.

Sec. 159.97 Safety: inspected vessels.

The Commandant approves the design and construction of devices to be certified for installation and operation on board inspected vessels on the basis of tests and reports of inspection under the applicable marine engineering requirements in Subchapter F of Title 46, Code of Federal Regulations, and under the applicable electrical engineering
requirements in Subchapter J of Title 46 Code of Federal Regulations.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.101 Testing: general.

Unless otherwise authorized by the Coast Guard, a recognized facility must perform each test described in Secs. 159.103 through 159.131. The same device must be used for each test and tested in the order in which the tests are described. There must be no cracking, softening, deterioration, displacement, breakage, leakage or damage of components or materials that affects the operation or safety of the device after each test described in Secs. 159.103 through 159.117 and Sec. 159.121, and the device must remain operable after the test described in Sec. 159.119. The device must be set up in a manner
simulating installation on a vessel in accordance with the manufacturer's instructions with respect to mounting, water supply, and discharge fittings.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.103 Vibration test.

The device, with liquid retention components, if any, filled with water to one-half of their volume, must be subjected to a sinusoidal vibration for a period of 12 hours, 4 hours in each of the x, y, and z planes, at the resonant frequency of the device (or at 55 cycles per second if there is no resonant frequency between 10 to 60 hertz) and with a peak amplitude of 0.019 to 0.021 inches.

Sec. 159.105 Shock test.

The device, with liquid retention components, if any, filled with water to half of their volume, must be subjected to 1,000 vertical shocks that are ten times the force of gravity (10g) and have a duration of 20-25 milliseconds measured at the base of the half-sine shock envelope.

Sec. 159.107 Rolling test.

(a) The device, with liquid retention components, if any, filled with water to half of their volume, must be subjected to 100 cycles with the axis of rotation 4 feet from the centerline of the device, no more than 6 inches below the plane of the bottom of the device, and parallel to any tank baffles. The device must then be rotated 90 degrees on its vertical axis and subjected to another 100 cycles. This testing must be repeated with the liquid retention components filled to the maximum operating level as specified by the manufacturer in Sec. 159.57.

(b) Eighty percent of the rolling action must be approximately 15 degrees on either side of the vertical and at a cyclic rate of 3 to 4 seconds. Twenty percent motions must be approximately 30 degrees, or the maximum angle specified by the manufacturer under Sec. 159.57, whichever is greater, on either side of the vertical at a cyclic rate of 6 to 8 seconds.

Sec. 159.109 Pressure test.

Any sewage retention tank that is designed to operate under pressure must be pressurized hydrostatically at a pressure head of 7 feet or to 150 percent of the maximum pressure specified by the manufacturer for operation of the tank, whichever is greater. The tank must hold the water at this pressure for 1 hour with no evidence of leaking.

Sec. 159.111 Pressure and vacuum pulse test.

Liquid retention components of the device with manufacturer specified venting installed must be subjected to 50 fillings of water at a pressure head of 7 feet or the maximum pressure specified by the manufacturer for operation of the device, whichever is greater, and then emptied with a 45 gallon per minute or larger positive displacement pump that remains in operation 30 seconds after emptying the tank at the end of each cycle.

Sec. 159.115 Temperature range test.

(a) The device must be held at a temperature of 60 deg.C or higher for a period of 16 hours.

(b) The device must be held at a temperature of -40 deg.C or less for a period of 16 hours following winterization in accordance with manufacturers' instructions.

Sec. 159.117 Chemical resistance test.

(a) In each case where the recognized facility doubts the ability of a material to withstand exposure to the substances listed in paragraphs (b) and (c) of this section a sample of the material must be tested.

(b) A sample referred to in paragraph (a) of this section must be partially submerged in each of the following substances for 100 hours at an ambient temperature of 22 deg.C.

(1) Sewage.

(2) Any disinfectant that is required in the operation of the device.

(3) Any chemical compound in solid, liquid or gaseous form, used, emitted or produced in the operation of the device.

(4) Fresh or salt (3.5 percent Sodium Chloride) flush water.

(5) Toilet bowl cleaners.

(6) Engine Oil (SAE/30).

(7) Ethylene Glycol.

(8) Detergents (household and bilge cleaning type).

(c) A sample of the material must be doused 20 times, with a 1 hour drying period between dousings, in each of the following substances:

(1) Gasoline.

(2) Diesel fuel.

(3) Mineral spirits.

(4) Turpentine.

(5) Methyl alcohol.

Sec. 159.119 Operability test; temperature range.

The device must operate in an ambient temperature of 5 deg.C with inlet operating fluid temperature varying from 2 deg.C to 32 deg.C and in an ambient temperature of 50 deg.C with inlet operating fluid temperature varying from 2 deg.C to 32 deg.C.

Sec. 159.121 Sewage processing test.

(a) The device must process human sewage in the manner for which it is designed when tested in accordance with this section. There must be no sewage or sewage-treating chemicals remaining on surfaces or in crevices that could come in contact with a person using the device or servicing the device in accordance with the instructions supplied under Sec. 159.57(b)(7).

(b) During the test the device must be operated and maintained in accordance with the manufacturer's instructions. Any initial start-up time specified by the manufacturer must be allowed before test periods begin. For 1 hour of each 8-hour test period, the device must be tilted to the maximum angles specified by the manufacturer under Secs. 159.55 and 159.57.

(c) Except for devices described in paragraph (d) of this section, the devices must process and discharge or store human sewage over at least an 8-consecutive hour period on at least 10 days within a 20-day period. The device must receive human sewage consisting of fecal matter, urine, and toilet paper in a ratio of four urinations to one defecation with at least one defecation per person per day. Devices must be tested at their average rate of capacity as specified in Sec. 159.57. In addition, during three periods of each day the system must process sewage at the peak capacity for the period of time it is rated at peak capacity.

(d) A device that processes and discharges continuously between individual use periods or a large device, as determined by the Coast Guard, must process and discharge sewage over at least 10-consecutive days at the average daily capacity specified by the manufacturer. During three periods of each day the system must process sewage at the peak capacity for the period of time it is rated at peak capacity. The sewage for this test must be fresh, domestic sewage to which primary sludge has been added, as necessary, to create a test sewage with a minimum of 500 miligrams of suspended solids per liter.

Sec. 159.123 Coliform test: Type I devices.

(a) The arithmetic mean of the fecal coliform bacteria in 38 of 40 samples of effluent discharged from a Type I device during the test described in Sec. 159.121 must be less than 1000 per 100 milliliters when tested in accordance with 40 CFR Part 136.

(b) The 40 samples must be taken from the device as follows: During each of the 10-test days, one sample must be taken at the beginning, middle, and end of an 8-consecutive hour period with one additional sample taken immediately following the peak capacity processing period.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.125 Visible floating solids: Type I devices.

During the sewage processing test (Sec. 159.121) 40 effluent samples of approximately 1 liter each shall be taken from a Type I device at the same time as samples taken in Sec. 159.123 and passed expeditiously through a U.S. Sieve No. 12 as specified in ASTM E 11 (incorporated by reference, see Sec. 159.4). The weight of the material retained on the screen after it has been dried to a constant weight in an oven at 103 deg.C. must be divided by the volume of the sample and expressed as milligrams per liter. This value must be 10 percent or less of the total suspended solids as determined in accordance with 40 CFR Part 136 or at least 38 of the 40 samples.

Note: 33 U.S.C. 1321(b)(3) prohibits discharge of harmful quantities of oil into or upon the navigable waters of the United States or adjoining shorelines or into or upon the waters of the contiguous zone. Under 40 CFR 110.3 and 110.4 such discharges of oil include discharges which:

(a) Violate applicable water quality standards, or

(b) Cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines. If a sample contains a quantity of oil determined to be harmful, the Coast Guard will not certify the device.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976; USCG-1999-5151, 64 FR 67176, Dec. 1, 1999]

Sec. 159.126 Coliform test: Type II devices.

(a) The arithmetic mean of the fecal coliform bacteria in 38 of 40 samples of effluent from a Type II device during the test described in Sec. 159.121 must be 200 per 100 milliliters or less when tested in accordance with 40 CFR Part 136.

(b) The 40 samples must be taken from the device as follows: During each of the 10 test days, one sample must be taken at the beginning, middle and end of an 8-consecutive hour period with one additional sample taken immediately following the peak capacity processing period.

[CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.126a Suspended solids test: Type II devices.

During the sewage processing test (Sec. 159.121) 40 effluent samples must be taken at the same time as samples are taken for Sec. 159.126 and they must be analyzed for total suspended solids in accordance with 40 CFR Part 136. The arithmetic mean of the total suspended solids in 38 of 40 of these samples must be less than or equal to 150 milligrams per liter.

[CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.127 Safety coliform count: Recirculating devices.

Thirty-eight of forty samples of flush fluid from a re-circulating device must have less than 240 fecal coliform bacteria per 100 milliliters. These samples must be collected in accordance with Sec. 159.123(b) and tested in accordance with 40 CFR Part 136.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.129 Safety: Ignition prevention test.

(a) Components of a device that are a potential ignition source in an explosive atmosphere must pass the test in paragraph (b) or (c) of this section or meet the requirements of paragraph (d) or have a specific warning in the instruction manual required by Sec. 159.57 that the device should not be installed in an explosive atmosphere.

(b) Components protected by vapor exclusion must be placed in a chamber filled with a rich mixture of gasoline or propane in air with the pressure being varied from 0 to 2 psig once an hour for 8 hours. Vapor readings must be taken in the void being protected and must indicate a leakage less than 20 percent of the lower explosive limit of the mixture in the chamber.

(c) Components providing ignition protection by means other than vapor exclusion must be fitted with an ignition source, such as a spark plug, and a means of injecting an explosive mixture of gasoline or propane and air into the void that protects the component. Connections must be made so as to minimize any additional volume added to the protected void by the apparatus delivering the explosive mixture. The component must be placed in a chamber filled with an explosive mixture and there must be no ignition of the explosive mixture surrounding the component when the following tests are conducted:

(1) Using any overload protection that is part of the device, the potential ignition source must be operated for one half hour at 110 percent of its rated voltage, one half hour at 50 percent of its rated voltage and one half hour at 100 percent of its rated voltage with the motor or armature locked, if the potential ignition source is a motor or part of a motor's electrical circuit.

(2) With the explosive mixture in the protected void, the test installed ignition source must be activated 50 times.

(3) The tests paragraphs (c) (1) and (2) of this section must be repeated with any plugs removed.

(d) Components that are certified as being intrinsically safe in accordance with the Instrument Society of America (RP 12.2) or explosion proof in accordance with the Underwriters Laboratories STD 698 in Class I, Group D hazardous locations (46 CFR 111.80-5(a)) need not be subjected to this testing.

Sec. 159.131 Safety: Incinerating device.

An incinerating device must not incinerate unless the combustion chamber is closed, must purge the combustion chamber of combustible fuel vapors before and after incineration must secure automatically if the burner does not ignite, must not allow an accumulation of fuel, and must neither produce a temperature on surfaces adjacent to the incineration chamber higher than 67 deg.C nor produce a temperature on surfaces in normal body contact higher than 41 deg.C when operating in an ambient temperature of 25 deg.C. Unitized incineration devices must completely burn to a dry, inert ash, a simultaneous defecation and urination and must not discharge fly ash, malodors, or toxic substances.

Subpart D--Recognition of Facilities

Sec. 159.201 Recognition of facilities.

A recognized facility is an independent laboratory accepted by the Coast Guard under 46 CFR 159.010 to perform the tests and inspections required under this part. A list of accepted laboratories is available from the Commandant (G-MSE-3).

[CGD 95-028, 62 FR 51194, Sept. 30, 1997, as amended by USCG-1999-5832, 64 FR 34715, June 29, 1999]

THIS PAGE LEFT INTENTIONALL BLANK